TOOLING & PRODUCTION
Magazine

10th Annual
CARBIDES FEATURE ISSUE

FEBRUARY 1959

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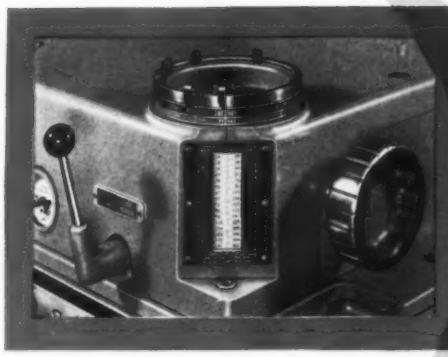

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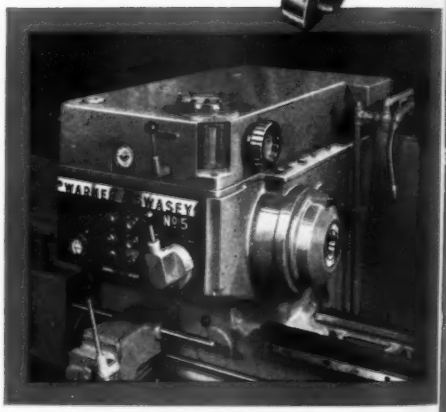

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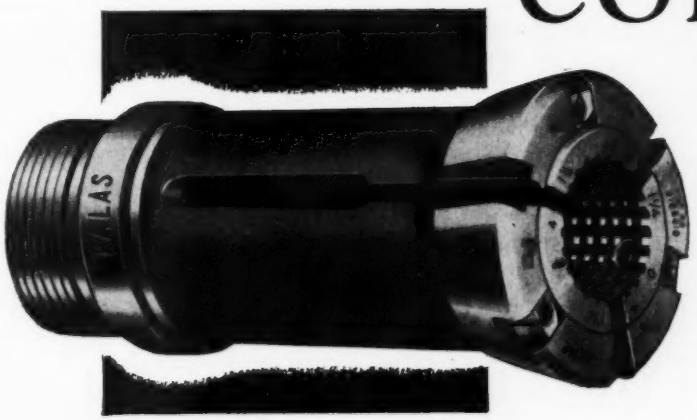

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TOOLING & PRODUCTION Magazine

FEBRUARY 1959
VOL. XXIV No. 11
GEORGE J. HUEBNER, Founder
1885 - 1956

PERSONALLY SPEAKING

Dear T & P Reader:

In this column we previously have urged that special attention be given to modernization of production equipment and facilities. It's obvious that U. S. Industry is doing something about it. Sales of new U. S. built machine tools are showing some recovery and, for whatever it is worth as a barometer, sales of used machine tools for the first eleven months of 1958 were 17% ahead of the corresponding period in 1957.

Good demand for used equipment can't help but favorably influence sales of new equipment. So, if the sales of used machines continue at present volume, and this is anticipated by those in the know, then there should be further significant gains in sales of new machine tools.

Once again, we urge you to get an equipment modernization program going. You will find it easier to get what you want when you want it if you do it now while the machine tool industry is operating at only a fraction of capacity.

Volume of business in the tool and die industry also is looking up. According to George S. Eaton, Executive Vice President of the National Tool and Die Manufacturers Association, the low point for the tool and die industry was reached last August. Orders in October, for example, gained about 35% over the low point reached in August. But in this industry, as in the machine tool industry, there is unused capacity at this time. So, if you have work for this industry to do, now is the time to place your orders.

Cordially yours,

Ray Huebner

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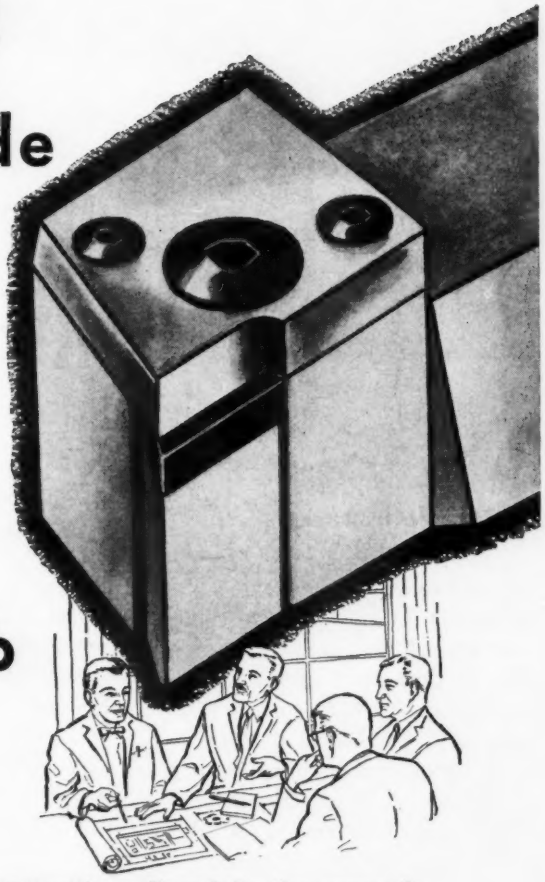
Production Men ENGINEER the Carbide in the Tools... for Best on-the-job Results



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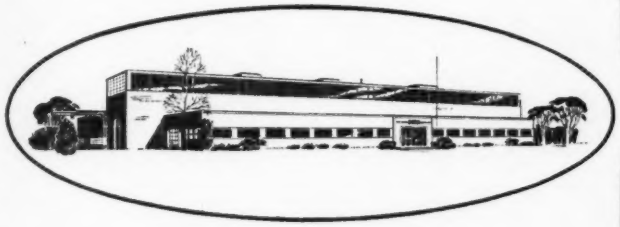

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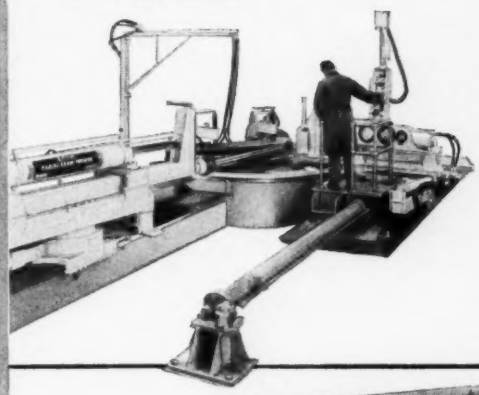

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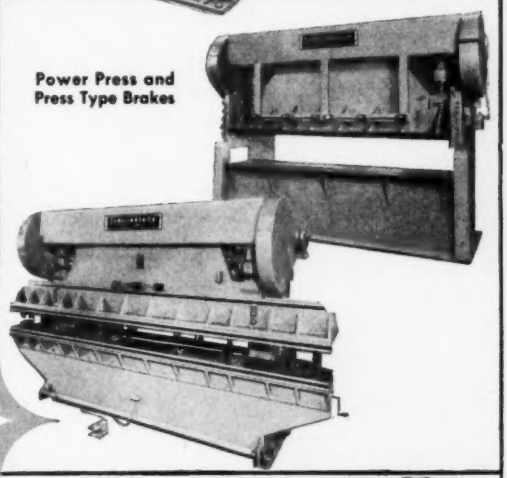

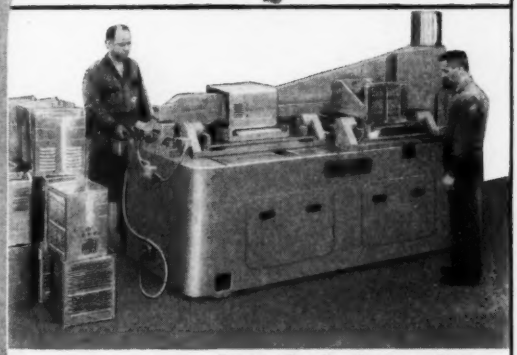

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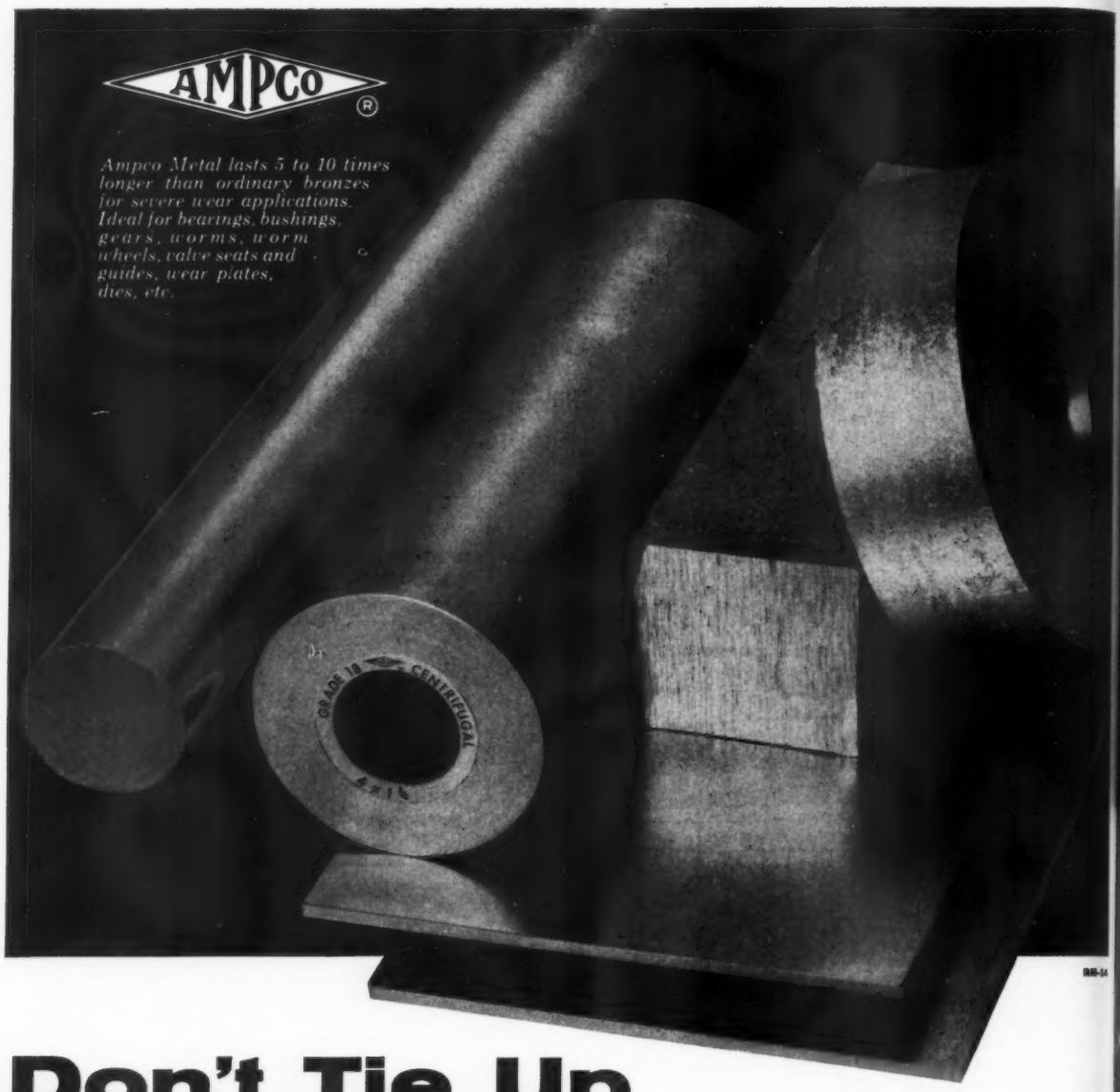
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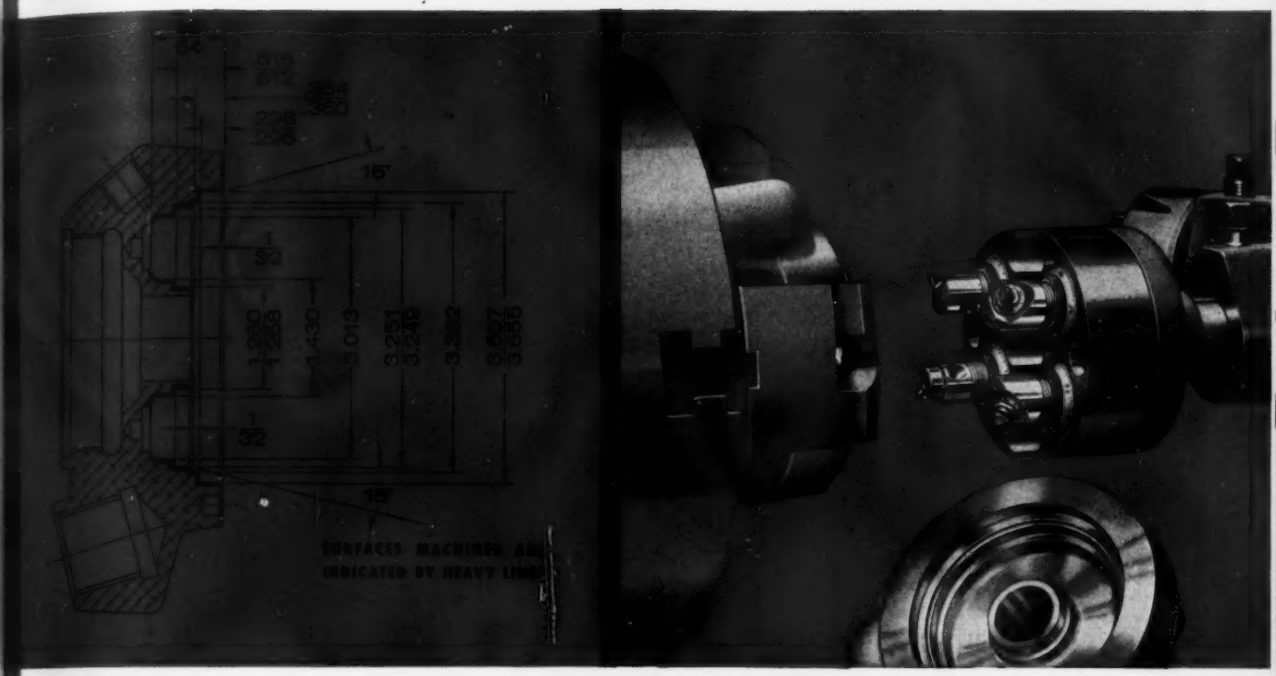

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Joe: these people have a lot of machines in Detroit. Look them over and let me have your reaction - Sam

★ ★ ★ ★ ★ ★ ★ ★

Talk of the Month

★ ★ ★ ★ ★ ★ ★ ★

DEPRECIATION AS AN ELEMENT IN INVESTMENT DECISIONS

by George Terborgh
Research Director
MACHINERY & ALLIED PRODUCTS INSTITUTE
Washington, D. C.

TAX DEPRECIATION ALLOWANCES impinge on investment decisions in two ways. First, they affect the amount of money business has available for capital purposes. Second, they affect the attractiveness of individual investment projects quite apart from their impact on the supply of funds.

Effect on the Supply of Funds

The importance of tax depreciation allowances for the supply of business investment funds is quite obvious. From the standpoint of its availability for capital investment, a dollar reported as taxable business income is subject to a twofold or double erosion. It is reduced both by the applicable income taxes (corporate and personal in the case of an incorporated business, personal in the case of proprietorship), and by any consumption expenditures made by the owners from the amount distributed as dividends or proprietary withdrawals.

With the present tax structure, this double erosion ordinarily leaves for investment only a minor fraction of the original dollar. When the dollar is reported as depreciation, on the other hand, it usually remains intact. As a capital recovery, it is tax free. Moreover, because it is a recovery and not income, it is normally regarded by management as

. . . Continued on page 12

Adapted, with permission, from the recent Tax Institute Symposium, "The Impact of Taxation on Management Responsibility: Depreciation and Compensation." The complete version of this talk (and all the symposium talks) is being prepared in book form by The Tax Institute, Princeton, New Jersey.

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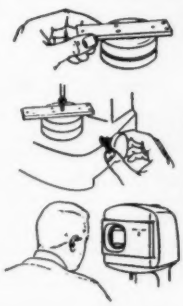

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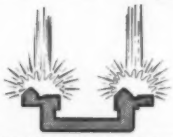
ALMOR TOOL COMPANY, Detroit, Michigan

"Dependably accurate — have more stamina, *CLAUSING* 5400-SERIES *LATHES* are the biggest lathe value we've found"



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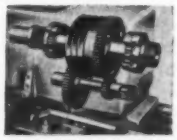

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UNDERNEATH DRIVE with choice of variable speed countershaft or 10-speed countershaft, with clutch and brake optional.

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CIRCLE INFORM-A-GRAM KEY NO. 12

. . . Month's Talk from page 11

unavailable for distribution, hence is protected against consumption by the owners. Both forms of erosion are thus avoided. From the standpoint of capital formation, a dollar of depreciation is worth several dollars of taxable income.

For this reason it is not surprising that tax depreciation allowances—or more accurately, the funds they make available when earned—are normally the largest source of business investment capital. In recent years, these allowances (including special amortization) have averaged over 60% of fixed-asset expenditures. Had they been adjusted, as they should have been, to allow for the effects of inflation, they would have covered a still higher proportion.

Let me say a word on this last point. The new depreciation methods of the Internal Revenue Code of 1954—sum-of-digits and double-rate declining-balance—provide for the first time reasonably realistic patterns of writeoff. They are applied, however, to historical cost, with no adjustment for the effects of inflation. I submit that when the purchasing power of the dollar is shrinking, the charging of historical cost—reflecting earlier, and hence lower, price levels — is insufficient for the restoration of the real capital used up in production. This means that the additional amounts required must come from what is accounted as profit. Obviously, this much of the so-called profit represents nothing but the unrecognized cost of making good capital consumption.

The deficiency of historical-cost accruals by reason of inflation is the main problem of tax depreciation today. The best measure of this deficiency I am able to make is in the vicinity of $6-billion a year. The taxation of this much capital consumption as income is clearly a serious drain on the ability of business to accumulate capital funds and by the same token, a drag on economic progress.

. . . . the present inadequacy of tax depreciation will not be remedied until management itself insists on a remedy.

Effect on Attractiveness of Investment

I turn now to the second impact of tax depreciation mentioned earlier, its effect on the attractiveness of individual investment projects.

Normally, the two effects are in the same direction, hence reinforce

. . . Continued on page 14

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CIRCLE INFORM-A-GRAM KEY NO. 13

interchangeable with all standard JIC cylinders

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CIRCLE INFORM-A-GRAM KEY NO. 14

. . . Months Talk from page 12

each other. Thus a liberalization of depreciation will both augment the available capital funds *and* otherwise increase the incentive for their investment. A change in the opposite direction will restrict funds and make investment otherwise less attractive.

This is widely recognized, both by business and by government. Our own government has thrice resorted to five-year amortization as a stimulus to investment in defense facilities during national emergencies. Other countries have used similar devices for this purpose. Less drastic speed-ups of tax depreciation are becoming increasingly popular as a stimulus to ordinary, or non-emergency, investment. . . . All of these measures have as a major objective the encouragement of normal peacetime capital formation.

Although the sponsors of these liberalized tax depreciation procedures have found it unnecessary to distinguish clearly between the two effects of which I have been speaking, in part, no doubt, because they reinforce each other, they can be separately analyzed. Let me begin the analysis of the second effect by propounding a question. Why does a more rapid tax writeoff make a proposed investment more attractive?

The general principle involved is simple. It rests on the fact that "time is money." Even when the total amount of depreciation deductions over the life of the asset is unaffected by their time distribution, it is normally worthwhile to get them as soon as possible. For the funds made available by the earlier tax benefits can be put to work in the taxpayer's business and can earn a return pending their absorption by additional tax liabilities later on when deductions are reduced.

There are, in addition, collateral advantages in an earlier timing of these deductions. By reducing tax liabilities in the early life of the assets affected, it increases the flow of cash available for debt retirement and similar purposes, thus facilitating capital financing. This accelerated cash flow likewise makes possible a faster recovery of investment from the taxpayer's own funds, thus reducing the risk of such investment. Finally, earlier timing of deductions gives greater assurance that they will be taken with tax benefit.

. . . Continued on page 17

TYPES AND CAPACITIES—MINSTER® PRESSES—A COMPLETE LINE

SINGLE POINT, GAP TYPE, OPEN BACK

Series 1

Inclinable
6 Capacities
12 THRU 60 TONS
Bulletin Section 1

Series 1

Inclinable
Two Capacities
75 THRU 90 TONS
Bulletin Section 2

Series 70

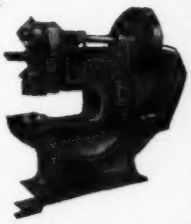
Fixed Base
Four Capacities
45 THRU 90 TONS
Bulletin Section 3

Series B1

Fixed Base, Automatic
Five Capacities
16 THRU 60 TONS
Gap Press Bulletin

Series G1

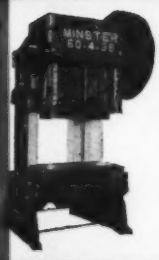
Fixed Base or Inclinable
Four Capacities
75 THRU 250 TONS
Bulletin Series G1



Series 20

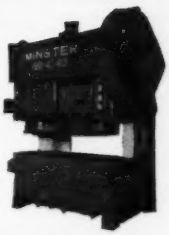
Deep Throat Type
Three Capacities
15 THRU 35 TONS
Gap Press Bulletin

TWO POINT, GAP TYPE, OPEN BACK



Series 60

Inclinable—Five Capacities
22 THRU 75 TONS
6 Widths Ea. Cap.
Request Specifications



Series 80

Fixed Base—
Five Capacities
22 THRU 75 TONS
6 Widths Ea. Cap.
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STRAIGHT SIDE PRESSES

Series S1

Twelve Capacities
50 THRU 600 TONS
Bulletin Series S1

Series S2

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STRAIGHT SIDE PRESSES—M SERIES

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300 THRU 500 TONS
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Series MS2

Five Capacities
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Bulletin Series MS2

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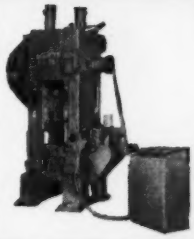

Series P1

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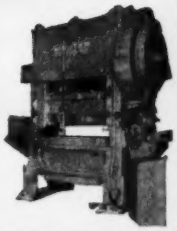
75 THRU 150 TONS
Bulletin Series P1



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20 THRU 300 TONS
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Six Capacities
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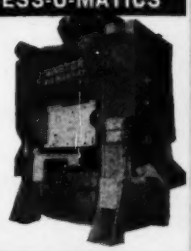

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Five Widths Ea. Cap.
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40E-9

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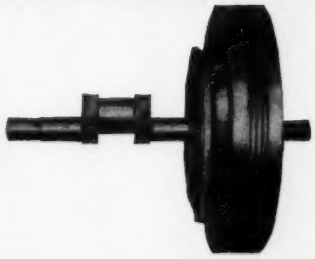
Bulletin CC57



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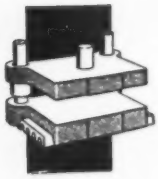

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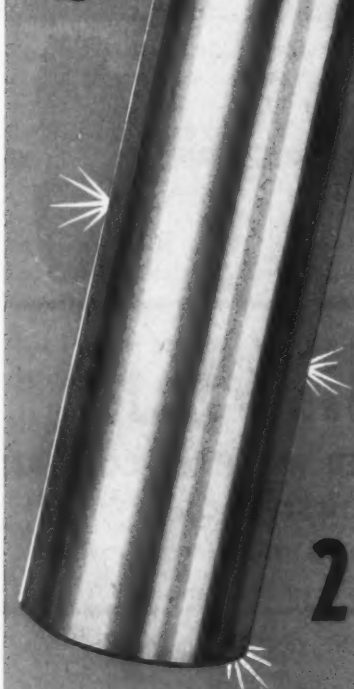

The process of Super Finishing removes the soft outer skin (appx. .0002-.0003) caused by the heat induced as a result of grinding.

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another die set advancement by

SUPERIOR STEEL PRODUCTS CORP.
2754 S. 19th ST., MILWAUKEE, WIS.

CIRCLE INFORM-A-GRAM KEY NO. 16

. . . Months Talk from page 14

It is one thing to describe these benefits; it is another to *measure* them. While actual measurement, based on statistical or other evidence, is probably impossible, it is possible to explore the magnitude of the effects by means of hypothetical cases.

The investigation falls into two parts. First, I shall explore the impact of different tax depreciation methods on the prospective after-tax return from an investment. Second, I shall trace their impact on the operating advantage required to justify investment.

I. EFFECT ON RATE OF RETURN

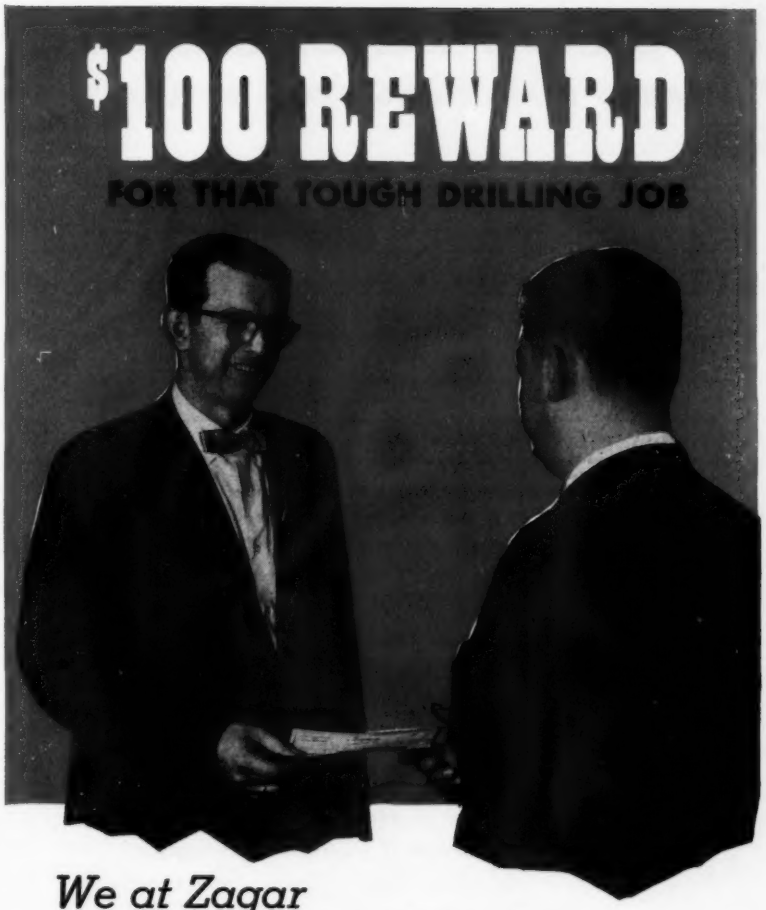
Most managements are aware that extra cash obtained by the deferment of tax liabilities through earlier depreciation can be reinvested in the business at a profit pending its absorption later on by the payment of the deferred liabilities. It is even possible, if a rate of profit is specified, to figure out what cumulative gain from this reinvestment will remain after the deferred payments have been made. It is not always realized, however, that the advantage of faster deductions does not depend on the reinvestment of the added cash received in the early years, but exists even though this cash is withdrawn from investment entirely. In this case the gain appears in the form of a higher rate of after-tax return on the investment in the depreciable asset itself.

The general principle involved in this improvement of the rate of return can be illustrated by a very simple example. If an investor commits $1,000 today and gets back $1,100 a year from now, his rate of return on the investment is 10% per annum. If, however, he gets back the $1,100 at the end of six months, his rate of return is 20% per annum. With the same recovery in three months, the rate is 40%. Similarly, an earlier receipt of the amounts available for capital recovery and after-tax return over the life of a depreciable asset, arising from the use of a faster tax depreciation method, spells a higher rate of return.

The Problem of Projection

To measure the effect of different writeoff methods on the after-tax return from a depreciable asset, it is necessary to estimate the amounts the asset will yield year by year over its service life *before* income tax and depreciation. These amounts

. . . Continued on page 18



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make the following offer:

We'll send you our check in the amount of $100 for every lead that materializes into an order for a drilling machine with these specifications:

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CIRCLE INFORM-A-GRAM KEY NO. 17

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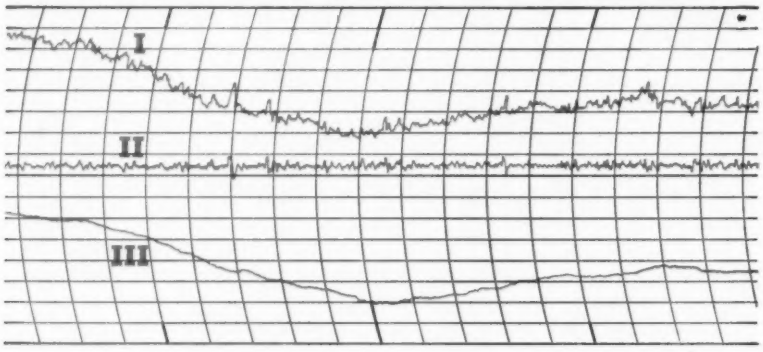

Three Proficorder records of same portion of a surface, reproduced 1/2 size, showing (I) total profile, (II) roughness profile, and (III) waviness profile. Note range of detail.

THE PROFICORDER draws a magnified profile of machined and finished surfaces, showing the *height, width* and *relative position* of the surface irregularities. It clearly shows any desired detail from over-all contour to fine roughness. Accordingly —

These charts permit detailed study and comparison of waviness . . . roughness . . . porosity . . . flaws . . . wear . . . and the effects of finishing processes.

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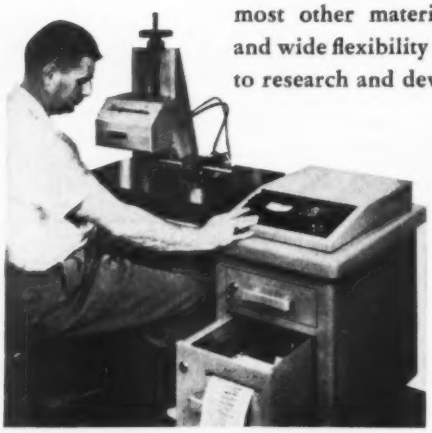

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gives details. Write for it! And let us furnish you with profile charts of surfaces in which you are interested.

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CIRCLE INFORM-A-GRAM KEY NO. 18

. . . Months Talk from page 17

—the excess of the revenue produced by the asset over the cash operating costs incurred by it—I shall refer to as its "earnings."

How can the earnings produced by a particular asset be estimated? If the asset is only one of many in a business—the usual situation—there is no separate identification of the revenue and operating costs generated by it. All that is really known is the operating margin of the business as a whole, which reflects the combined contributions of all elements concerned. The contribution of a single asset to this composite margin can be arrived at only by a process of imputation.

I do not propose to explore the nature of this imputational process here; an inquiry that would carry us too far afield. Nor is it essential for my purpose, for we can measure the effect of different tax depreciation methods in hypothetical cases if we are willing to make a reasonable assumption simply as to the *shape or time pattern* of the earnings over the service life of the asset.

But what is a reasonable assumption? I start with the proposition that if we have a wasting asset with a limited service life, its earnings at the end of that life are zero. (If they were more, its life would be longer.) My second proposition is that its earnings are largest at the start of its career when it is new and renders the most valuable service. If these two propositions are accepted, it follows that the shape of the earnings stream over the service life is some kind of declining pattern.

There are, of course, legitimate differences of opinion as to the most plausible pattern of decline to assume. I propose to use the simplest of all, namely, decline at a constant rate. This is the Standard pattern assumed for the MAPI investment formula, and seems to me . . . to be as good a general projection as can be made. I may add that reasonable variations from this projection would have only slight effect on the results.

Results of Different Methods

If we assume, for the purpose of the investigation, that the earnings of a depreciable asset decline over its service life at a constant rate, and if we make the stipulations necessary to "fix" the problem, we can solve for the after-tax return associated with any depreciation method.

. . . Continued on page 21

TOOL NEWS carbide

- *Slash Tool Costs*
- *Increase Output*
- *Eliminate Grinding*
- *Cut Tool Change Time*

WESSON Now Has 144 Standard Boring Bar Models

Rapidly growing demand for Wesson boring bars with throw-away carbide inserts has resulted in the standardizing of 144 models in four basic styles for quick delivery . . . and an end to your boring problems.

The new standard line includes 96 models that combine expendable inserts with precision adjustment for OD's. Bore diameters range from 1.50 to 2.60″. Either square or triangular inserts can be adjusted outward for a total range of 0.100 to 0.200″, depending on diameter. (Anvils and clamps for round inserts are available on request.) Right- and left-hand models are available for either deep-hole boring or shallow boring.

The Micro-Adjustable assembly is actuated by a screw with a head graduated in 0.001-inch divisions, guided by a keyway and held rigidly by a locking screw. High boring accuracy is assured with this quick, simple adjustment.

Where adjustability is not needed, there are 48 standard models in two basic designs for straight boring with a lead angle (square inserts), and for boring and facing (triangular inserts). These styles have either positive or negative rake angles.

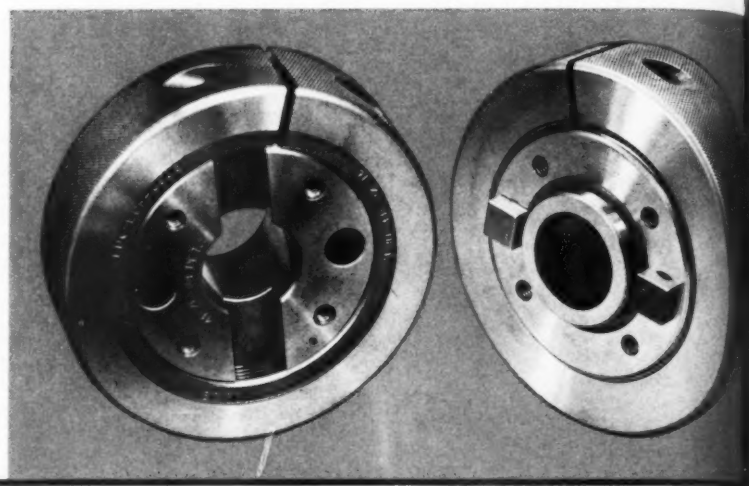
Write for Bulletin MB-1158 for data on standard Micro-Adjustable and nonadjustable boring bars using throw-away carbide inserts.

Combine Operations in One Tool

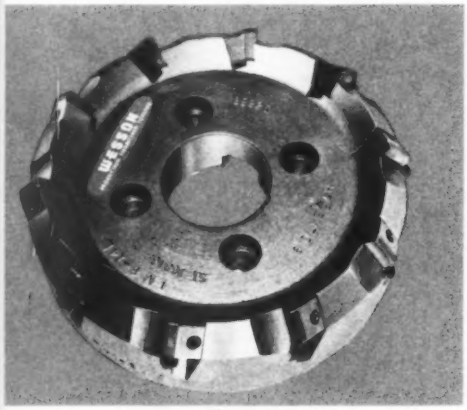
The adjustable throw-away insert principle can be adapted to a limitless variety of tools combining different operations. At left, is a complete tool —and all its components—for making 15 simultaneous cuts. Replaceable throw-away insert holders, ground to 0.001-inch tolerances and infinitely adjustable on both axial and radial dimensions, bore 3 steps, end face and chamfer automotive steering-gear housings at the Indianapolis plant of Chrysler Corp.

1 DO YOU GRIND FACE MILLS?
These adaptors will save you money

With the new Wesson Rigidcut micro-adaptors for milling cutters you can grind cutters an average of 4 times before re-setting the blades—also eliminates the need for costly adjustable milling cutter spindles. Permits presetting cutters on the bench. Total adjustment available is 0.125 in. Adaptors available for cutter diameters from 4½ to 12 in. Manufacturing precision is such that concentricity (indicated total runout) and squareness with face are held to within 0.0005 in. Ask for Bulletin 158.

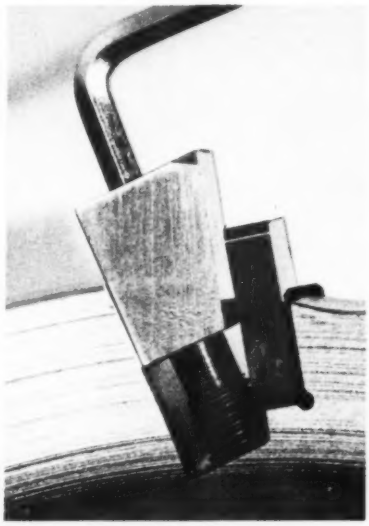


2 WANT TO STOP GRINDING FACE MILLS?
Throw-aways are the answer on many jobs



The cutter . . .

Reduce your cutter inventory. Rough or semi-finish cast iron or steel — *all with the same cutter body.* Just change the Wessonmetal throw-away inserts. Each insert has eight cutting edges. Inserts are backed by quickly replaceable low-cost hardened steel anvil-wedges designed to protect the cutter body against accidental damage. Cutters available in 4 lead angles—15, 30, 45 and 87 degrees. Ask for Bulletin #358-M.



How it locks . . .

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. . . Months Talk from page 18

I propose the following stipulations:

1. There is no terminal salvage value,
2. The income tax rate is 50%,
3. The investment is entirely equity capital,
4. The rate of return obtained with straight-line tax depreciation is exactly 10%.

On the basis of this structure of assumptions and stipulations, I have computed the after-tax returns obtained with double-rate declining-balance depreciation (with straight-line switch), sum-of-digits depreciation, five-year amortization, and expensing. The results, charted for service lives of 5 to 50 years gives an interesting picture.

When the return is 10% with the straight-line writeoff, it ranges up to 17.4% with expensing, and up to 14.6% with five-year amortization, depending on the assumed service life. The gains from sum-of-digits and double-rate declining-balance depreciation are more modest, but even here they are substantial. Over the life range covered, returns vary from 10.7% to 11.2% for the former and from 10.6% to 11.4% for the latter. Obviously, differences in tax depreciation methods can have a profound effect on the profitability of investment in wasting assets, and a profound effect, accordingly, on the incentive to make such investment.

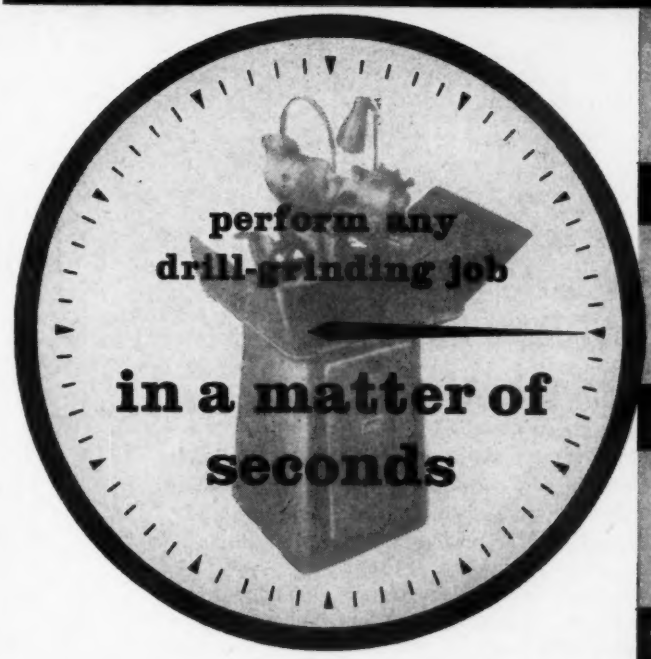
Five-year amortization is now largely out of the picture so far as new projects are concerned. Expensing of long-lived investment is of course severely restricted. This narrows the practical choice in most cases to straight-line depreciation, or some modification thereof, and one of the new methods authorized in the 1954 Code. It is evident that these methods offer a very worthwhile advantage over straight-line from the standpoint of return. Certainly this showing suggests the desirability of switching to one of them if you have not already done so. Where else can you obtain a profit improvement of this magnitude with so little trouble and expense?

II. EFFECT ON THE OPERATING ADVANTAGE REQUIRED TO JUSTIFY INVESTMENT

I turn now to the second phase of this inquiry, which has to do with the effect of different tax depreciation methods on the operating advantage required to justify investment in a depreciable asset.

. . . Continued on page 24

new, revolutionary
ALINA
SELECT-O-POINT
drill grinders

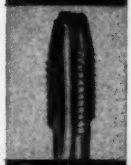


Right-hand twist drill, with centre

Twist drill for soft material, lips corrected

Three-flute drill core drill

Spot facing cutter, countersink angle 60


Screw tap, grinding of the angle of rake

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Keyway Milling Cutters • End Mills
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Three models to choose from — *No. 01-2 Range .004" thru .080"—No. 03-6 Range .012" thru .240"—No. 2-32 Range .093" thru 1.250".* Each machine is a complete system built around a *planned drill point.* Applied to twist drills, this new drill point will increase the useful life of your drills — reduce the drill thrust force — eliminate the need for center punching — produce a rounder and more accurate hole — and on the larger drills afford you a drill point that will produce a round and almost burr-free hole in sheet metal. Fully variable adjustments may be accomplished with a minimum of effort; settings once selected may be altered or repeated *exactly* at any time. Accuracy and simplicity is built into each machine.

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- **machine where it is most economical**
- **eliminate down-time and set-up expense**
- **reduce substantially your overall machining costs**

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Basic unit mills, bores, drills, reams and faces at 13 variable speeds from 44 to 450 rpm. Converts lathes into complete machine shops.

Combined with accessories, it shapes, slots, thread mills, cuts, grinds (external, internal, surface and thread) and other operations at speeds from 33 to 18,000 rpm.

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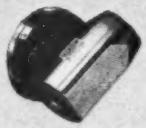
For drilling, reaming, boring, routing and small diameter end millings. Speeds 540 to 5500 rpm. **$160***



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External unit for wheels from 3" to 6". Uses flat vibration-free belts for speeds to 6900 rpm. **$180***

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Two or three bearing spindles for depths to 14". Wheels from ⅜" to 4" diameter. From **$180***

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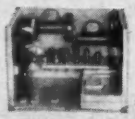
FEED TABLES
Provide longitudinal and in-feed movements. Four sizes for feeds 3⅜" to 42½", only 3¾" high. From **$260***



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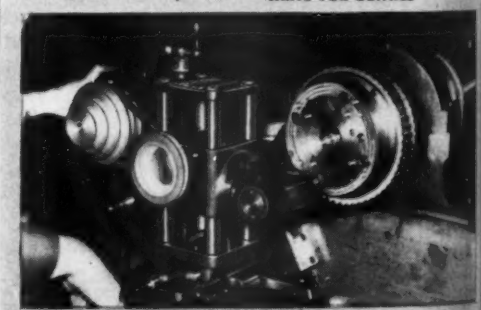

ALCO MACHINE & TOOL CO., Cleveland, Ohio, saved three days dismantling time . . . by taking Dumore Versa-Mil, Universal Head and Feed Table to repair this Airfoil Machine in place.

Talking About Die Sets

with

Phil Marsilius

Executive Vice-President
The Producto Machine Co.

Die Set Maintenance in the Pressroom—The vital die-maintenance procedures required periodically when a die is removed from the press for sharpening should be coupled with systematic die set inspection and maintenance in the pressroom.

In addition to having a planned schedule of lubrication (based on any of the methods previously discussed in this space), you can make sure of getting the most out of your investment in die sets—and the costly dies and presses with which they are used—by following a simple set of procedures for inspecting and maintaining die sets in the pressroom.

Although there are no hard-and-fast rules that can be established for all die sets, the procedure listed below is generally followed at leading stampings plants in the East. These companies point out that die sets used in the cutting of extremely thin material or for very critical parts would naturally require a more stringent inspection than those used for blanking heavy material or for comparatively simple parts.

At one plant, specializing in long runs of close-tolerance parts for the electronics industry, the procedure followed is:

1. No inspection of the die set during production run unless, of course, there is overheating, pick-up on the guide pins or other obvious difficulties.

2. When the die is taken off the press for sharpening or maintenance, the die set is visually inspected for pick-up or score marks on either the guide pins or bushings. Pins and bushings are carefully cleaned to remove excess lubricant.

3. After approximately 1,500,000 strokes, the set is thoroughly checked for wear on both the pins and bushings. On the average, up to .0003″ wear on pins and bushings is allowed before replacement with new components is scheduled. In addition, the die set is placed on a surface plate and an indicator is placed over one end of the set. An attempt is then made to rock or twist the set by hand to establish how much the die set can be deflected. On a 10″ set, a maximum of .005″, but usually less, total deflection is allowed.

Because the die set plays such an important part in prolonging the accuracy and lifetime of a die, it pays to take the little extra time required to do justice to die set maintenance in the pressroom.

4. During regular or periodic regrinds, the die set is not checked for bent or distorted punch and die holders unless the die has been damaged or there is reason to believe the set may have warped.

During the overall period, if the pins and bushings are replaced, the punch and die holders themselves are checked for warpage or distortion. If necessary, these components are reground prior to assembling the new pins and bushings.

Four-stage blanking and shaving die, Lenkeit Machine & Tool Co., Inc.

pressroom foreman prefers Producto die sets

They keep his downtime down

Keeping production *up* and downtime *down* is the main job of the pressroom foreman. He knows Producto die sets can help him do this job successfully because they maintain accuracy for long runs. All catalog steel sets are annealed to prevent distortion.

He is aware that Producto can provide him with any type of die set he needs—whether for standard or special presses—in a wide range of sizes and thicknesses, with or without clamping flanges.

The pressroom foreman knows that Producto guide pins are mirror-finished to eliminate scoring, and that Producto die sets are available with a variety of lubrication devices to keep them "running cool".

He knows, too, that he is not restricted to the use of predetermined press stroke or shut height because Producto offers an unlimited choice of pin and bushing lengths. Moreover, he can get the bolster he needs to protect his die at the same time he gets his die set. Both die set and bolster can be ordered in steel or cast semi-steel depending on strength requirements.

The pressroom foreman realizes that Producto Qwik-Fit Die Sets make "take-apart-and-put-together" easy during die maintenance. He also knows that Qwik-Fit removable pins and clamp-type bronze bushings are available when the application calls for them.

He can *produce more* with Producto die sets. So can you.

A WEALTH OF DIE SET KNOWLEDGE is packed into Producto's Catalog No. 11 and regular issues of *Die Set Digest*. Write today for these free aids.

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Wherever die sets are used

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PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS

Now

AUTOMATIC POSITIONING

with the

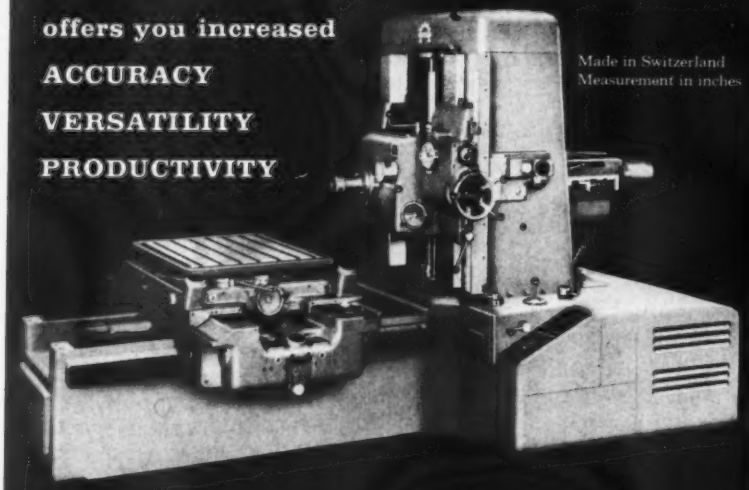
DIXI 75 horizontal optical jig borer

offers you increased

ACCURACY

VERSATILITY

PRODUCTIVITY



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Measurement in inches

- Automatic positioning can be changed instantly to manual operation
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- Simplified controls functionally arranged for greater operating speed and efficiency
- 3" diameter boring spindle
- Increased capacity: table size 39⅜" x 32"; 29⅝" cross travel; 23⅝" longitudinal travel; 25⅝" vertical travel
- Hydraulic feeds and infinitely variable spindle speeds
- Rear support optional

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WESTERN METAL CONGRESS AND EXPOSITION
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CIRCLE INFORM-A-GRAY KEY NO. 24

. . . Months Talk from page 21

A word first on the concept of "operating advantage." You are all familiar with the popular expression, the "saving" from a proposed project. Ordinarily, this is the saving for the first year of project operation (or the first year after break-in where a substantial shakedown period is involved) and is commonly referred to as the "next year saving." The operating advantage is simply a more comprehensive measure of the next-year benefit of the project to the business. It includes not only the operating-cost reductions covered in the usual computation of "saving" but any improvement in the revenue of the business. In short, it reflects the *total* operational improvement resulting from the investment.

The operating advantage required to justify investment, or more simply, the "required advantage," is the next-year advantage the investment must show in order to yield the required rate of return. Unlike the *actual* advantage, which can be estimated on the basis of next year alone, the *required* advantage calls for a series of estimates and projections covering the entire life of the proposed asset. It is therefore an extremely difficult magnitude to figure.

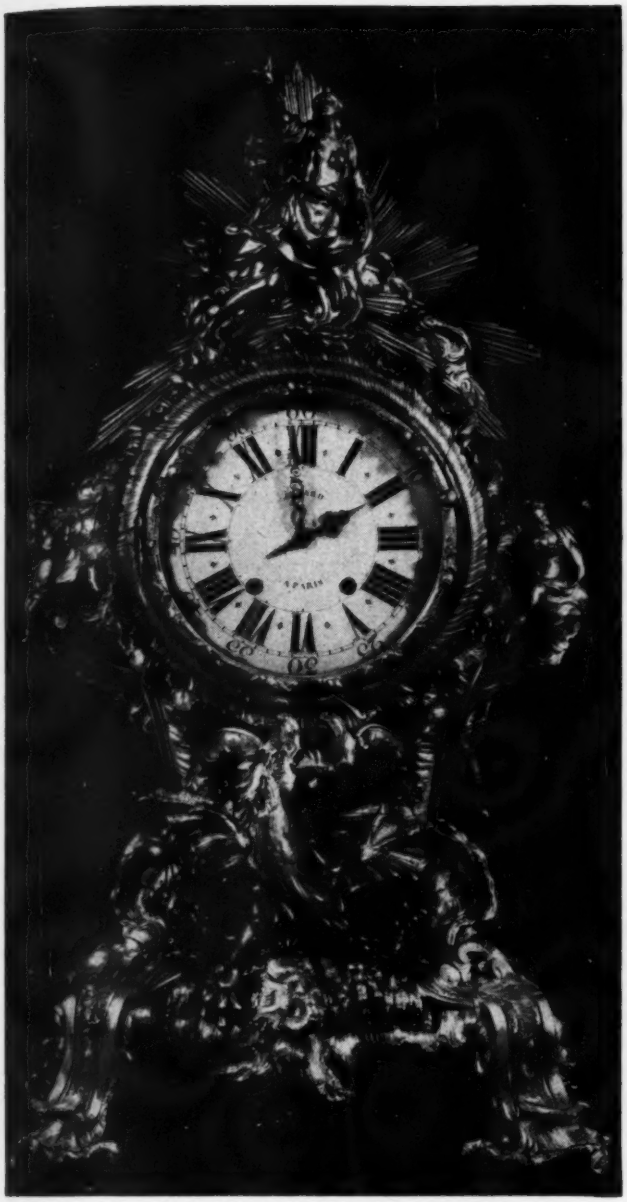
* * * *

Let me add that the earnings of depreciable assets are projected on the same assumption used previously, namely, that they will decline over the asset life at a constant rate. Again the stipulations include no terminal salvage, a tax rate of 50%, and all equity investment. For the present calculation, however, it is assumed that the required after-tax return is 10% *regardless of the depreciation method employed.*

The solution provides the answer to this question: Given the stated assumptions and stipulations, what next-year operating advantage must the asset show in order to yield an after-tax return of 10% on the investment? The results again present an interesting picture. It is evident that the operating advantage required to justify investment varies inversely with the acceleration of the tax depreciation method employed. It is highest for straight-line, lowest for expensing. Other writeoff methods yield intermediate results.

What does this mean? It means that slow tax writeoffs operate to *delay* investment by increasing the required operating advantage. The

. . . Continued on page 28



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WHEN you're in a rush for 52100 tubing, why not use our mill warehouse stock? We'll have your order on its way in 24 hours from our stock of 101 sizes, ranging from 1″ to 10½″ O.D. with a wide selection of wall thicknesses. It's handy to use when you need less than mill quantities, too!

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That's why Timken 52100 steel is so widely used—for aircraft engine parts, ball bearing races, pump parts and plungers, collets, bushings, spindles, grinding machine parts, precision parts and dozens of other uses.

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SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

CIRCLE INFORM-A-GRAM KEY NO. 25

This 24-ft. boring mill is facing a disc of 300 stainless . . . a difficult machining operation . . . but this 3-man team quickly found the answer.

This 3-Man Team makes expensive machines pay off

Every time some new alloy must be machined, new problems arise as to the best tool, grade of carbide, feeds, speeds and depth of cut to use. Modern mills and machines are too costly to permit a lot of experimenting with resultant downtime.

The only sure and economical way is by pooling the know-how of a 3-man "tooling team." The Tool Engineer knows the job requirements; the Machine Operator contributes his machining skill; and your Kennametal Carbide Engineer provides information on the latest developments in carbide tooling.

Such a 3-man team can best determine the proper tools required for the job . . . then fill those requirements from the extensive line of Kennametal* tooling. Spearheaded by the Kendex* (patented) line of "throw-away" insert tooling with more than 50 standard styles, plus many adaptations for special needs, Kennametal offers a selection that will provide the right tool for every job . . . for every shop, whether large or small.

Call in your Kennametal Carbide Engineer today to help you get the best tooling for every machine and material . . . applying Kennametal and helping to solve tough machining problems is his *full-time* job. Or write KENNAMETAL INC., Latrobe, Pennsylvania.

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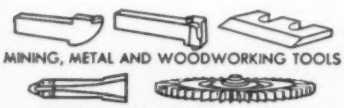

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WEAR AND HEAT-RESISTANT PARTS

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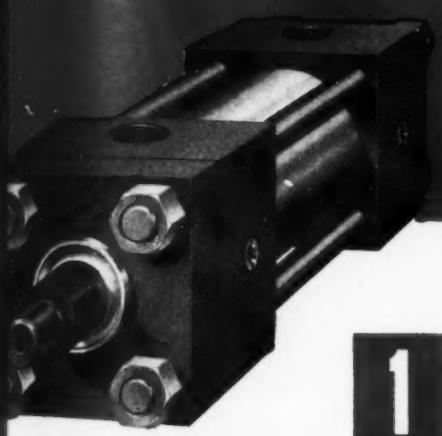
...m base, fire-resistant and special hydrau-
...e cause distortion and rapid deterioration
... seals currently used in many hydraulic
...rs, resulting in costly repairs and cylinder
... (Seals made of synthetic rubber are not
...ible with even 50% of available com-
... petroleum base fluids and the life of such
... practically reduced at operating tempera-
...bove 150° F.)



...uest Bulletin JH-104N for complete
...a plus helpful charts on column
...ength, cylinder forces, factors of
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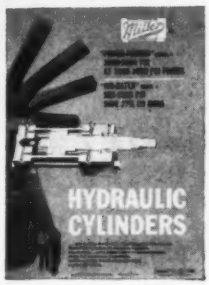
...ses, etc.



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FOR UNLIMITED SEAL LIFE!

1 ALL TEFLON* SEALED Against External Leakage

TEFLON is impervious to all known hydraulic fluids, including all fire-resistant and special types – and withstands temperatures from —100°F. to plus 450°F.

TEFLON SHEF SEAL AT TUBING ENDS

No blind assembly. Is
Shear-proof
Heat-proof
Extrusion-proof
Fluid-proof

TEFLON SEALS ON PISTON ROD AND BUSHING

Teflon rod flange seal requires no adjustment. Teflon bushing seal is shearproof. Teflon wiper keeps dirt out.

TEFLON SEALS ON BALL CHECK AND ADJUSTING SCREW

Non-protruding, self-locking, cushion adjusting screw interchangeable with ball check for easy access.

2 CASE-HARDENED CHROME PLATED PISTON RODS

Provide foolproof protection against seal failures resulting from rod damage. The Miller case-hardened rods (50-54 Rockwell C) give practically complete immunity to damage from hammer blows, wrench-dropping, mishandling, etc. The hard chrome plating over the case-hardened rods protects against scratch-damage and rust.

AVAILABLE IN TWO TOP QUALITY LINES

JOB-RATED
Model "J"

PRICE SAVINGS
27% OR MORE!

...mounting styles, strokes, cushioned and non-cushioned. Large selection for immediate shipment.

BORE	SEVERE OPERATING CONDITIONS	MODERATE OPERATING CONDITIONS	YOU SAVE THIS % IN PRICE OVER STANDARD 2000-3000 PSI CYLINDERS
1½"	1500 PSI	2500 PSI	27%
2	1500	2500	27%
2½	1000	1500	28%
3¼	1500	2500	32%
4	1000	1500	35%
5	800	1200	37%
6	800	1200	43%
8	500	800	50%
10	500	800	71%
12	500	800	76%
14	500	800	*Not Available in 2000-3000 PSI*

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Model "H"

50% More Power Per Cylinder Dollar!

For
3,000-5,000 P.S.I.

1½" through 12" bores, 17 mounting styles, strokes up to 22 ft., cushioned and non-cushioned. Large selection for immediate delivery.

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S SHEAR PROOF
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SEAL
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Hydraulic Cylinder Tubing End Seal
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OTHER MILLER QUALITY FEATURES

- Solid Steel Heads, Caps and Mountings.
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AIR AND HYDRAULIC CYLINDERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS • BOOSTERS

PEM self-clinching template drill bushings

Save time . . . . . Cut costs

For faster, easier installation in thin gauge aluminum or cold rolled steel templates. (one third conventional thickness)

Pay for themselves in assembly savings. Only one hole is required for each bushing—the hole to be bushed. Then, simply drop bushing in hole and squeeze into place.

Self-clinching, PEM Bushings are compression mounted and positively locked into position—one or several at a time.

Round, one-piece, hardened steel precision units—not assemblies. Require no indexing or nesting; No tabs, straps or other outboard supports; no locating, punching or drilling and countersinking of rivet holes; no riveting, hence no danger of "cocking" during riveting.

No special machinery or skilled labor required.

True alignment and center distances are automatically secured by piloting effect of leading edge of shank and interference fit, if proper installation procedure is followed.

High torque and pull out resistance are provided by back-tapered shank and corrugated clinching ring.

Complete line for drill sizes from .052″ to .750″

PENN ENGINEERING & MANUFACTURING CORP.

Doylestown, Pennsylvania

Write for literature ***Ask for trial sample***

PEM

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. . . Months Talk from page 24

deterioration and obsolescence of existing facilities and arrangements that create the operating advantage from new projects do not occur overnight. They accumulate, as a rule, slowly. While they are building up to the required level, investment is precluded. The higher the requirement, obviously the longer the deferment.

It is a corollary of this proposition that slow writeoffs tend to extend the economic service lives of productive facilities. They not only hold an umbrella over existing capacity by deferring replacement investment; once this investment is made, it is protected in turn by the barrier against its own successor. By the same token, fast writeoffs make for shorter service lives.

In Conclusion . . .

I have attempted by means of hypothetical cases to indicate the effect of different tax depreciation methods on the attractiveness of individual investment projects. While the solution of such cases cannot offer a fully realistic measure of the *magnitude* of the effect, it certainly can indicate its *direction*. There can be no doubt that liberalization of depreciation increases the incentive to invest. It raises the after-tax return, and lowers the operating advantage required to justify.

I must remind you again that this stimulus to investment through increased incentive, which I have called the second effect of liberalization, is in addition to the stimulus through increased capital funds, the first effect. The real payoff is of course the two benefits in combination. This can be very substantial indeed.

WIDEST STEEL SHEET

The widest sheet of high strength steel has been rolled by Lukens Steel Co. for use in rocket motors. The sheet measures 160″ wide — about one-third wider than the widest sheet previously produced by the pack-rolling methods and almost twice as wide as materials produced by other commercial sheet mills.

BRAZES LARGE ASSEMBLIES

A new giant dry hydrogen furnace that permits vertical brazing of assemblies up to 10′ long and 6′ dia has been installed at the Detroit plant of the Stainless Processing Div'n of Wall Colmonoy Corp. This instrument-controlled unit is available for controlled atmosphere brazing, heat treating, and annealing of parts up to 72″ dia.

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Fastest-Changing Toolholder

SANDVIK Coromant T-MAX

With Exclusive "Autolift", Triple-Purpose Low Cost Chip Breaker

52 NEW SIZES!
In A Wide Variety of Styles
— Positive Rake and Other Popular Holders

Loosen, change, tighten... and you're back in production. It's as quick and easy as that with Coromant T-Max... *newest,* fastest throwaway-type, carbide toolholder on the market.

Only T-Max enables you to change either or *both* the carbide cutting edge and depth of cut *without removing or replacing chip breaker.*

When set screw is loosened, a spring-loaded pin automatically lifts and holds chip breaker against clamp – lets you change or index insert with no waste motion. When changing cut, a push with the wrench clicks the solid carbide chip breaker into desired position for light, medium or heavy cut.

- **Precision-made recess seats insert *accurately*—insures machining precision.**
- **No protruding parts—two or more holders easily clamped together.**
- **Shank of heat treated alloy steel, HRC 50, guards against damage. Special SR treated, anti-rust finish.**
- **Precision cast, alloy steel clamp is streamlined for free chip flow.**
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This manufacturer uses air power to put clock assemblies together in a hurry. The main spring in this high-speed production: Gardner-Denver air screw drivers. At a touch screws spin tightly to preset torque . . . a cushion clutch eliminates runaway bits and over-torquing. In seconds the operator is ready for the next assembly.

Leading manufacturers everywhere keep production in time with air tools—Gardner-Denver drills, screw drivers, nut setters, ratchet wrenches, multiple drilling and fastening machines. They're fast, safe, easy to operate. Write today for air tool bulletins.

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CIRCLE INFORM-A-GRAM KEY NO. 30

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In jig or fixture manufacture, it's both expensive and time-consuming to design and machine special index plungers for multi-station tools. To save time and money use Universal Straight or Taper Plungers. They are made in standard sizes . . . come complete, ready for installation . . . at approximately ¼ the cost of specially made tool room plungers. Universal Index Plungers can be assembled from either top or bottom and can be removed in either direction. Because the Universal plunger body and bushing have the same standard diameter . . . all holes can be bored with the same tool, simplifying drilling of jig or fixture in fabrication.

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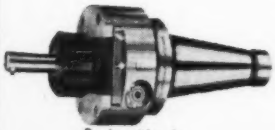
211

Floating Chuck

Standard Collet Chuck

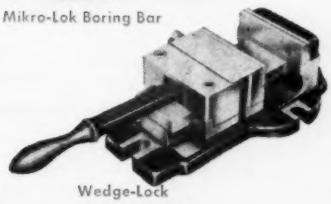
Mikro-Lok Boring Bar



Boring Chuck

"Kwik-Switch" Tool Holder

Standard Drill Bushing



Wedge-Lock Production Vise

UNIVERSAL ENGINEERING COMPANY, FRANKENMUTH 8, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 31

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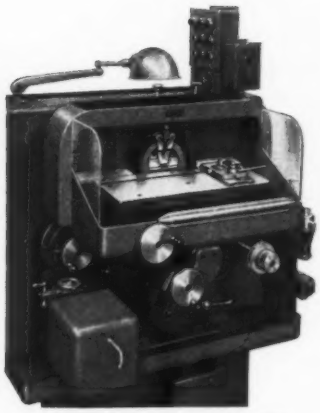
Hammond presents

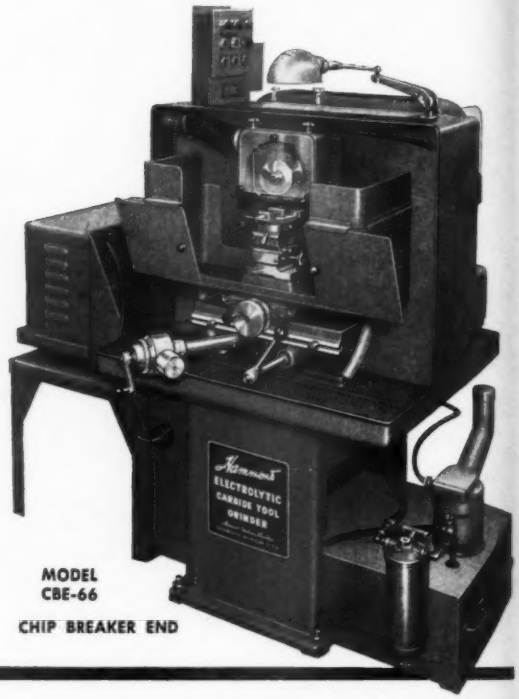
NEW ELECTROLYTIC CHIP BREAKER AND OSCILLATING CUP WHEEL GRINDER

FOR CARBIDE TOOLS

SPECIALLY DESIGNED FOR THE
ELECTROLYTIC
PROCESS



OSCILLATING CUP WHEEL END



MODEL
CBE-66
CHIP BREAKER END

The NEW Model CBE-66 Electrolytic Combination Chip Breaker and Oscillating Cup Wheel Grinder is an ideal "all around" Grinder for single point carbide tools and insert slugs as —

- The cup wheel has variable oscillation and the automatic "pushbutton" air table can be furnished.
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Designed especially for the Anocut Electrolytic Process, the CBE-66 provides all the proven advantages of electrolytic carbide tool grinding — easier, faster and better grinding, reduction of 80% to 90% in diamond wheel consumption and elimination of heat fractures.

If your requirements do not justify two machines — one for cup wheel grinding, the other for chip breaker grinding, the CBE-66 is the answer. Write for catalog.

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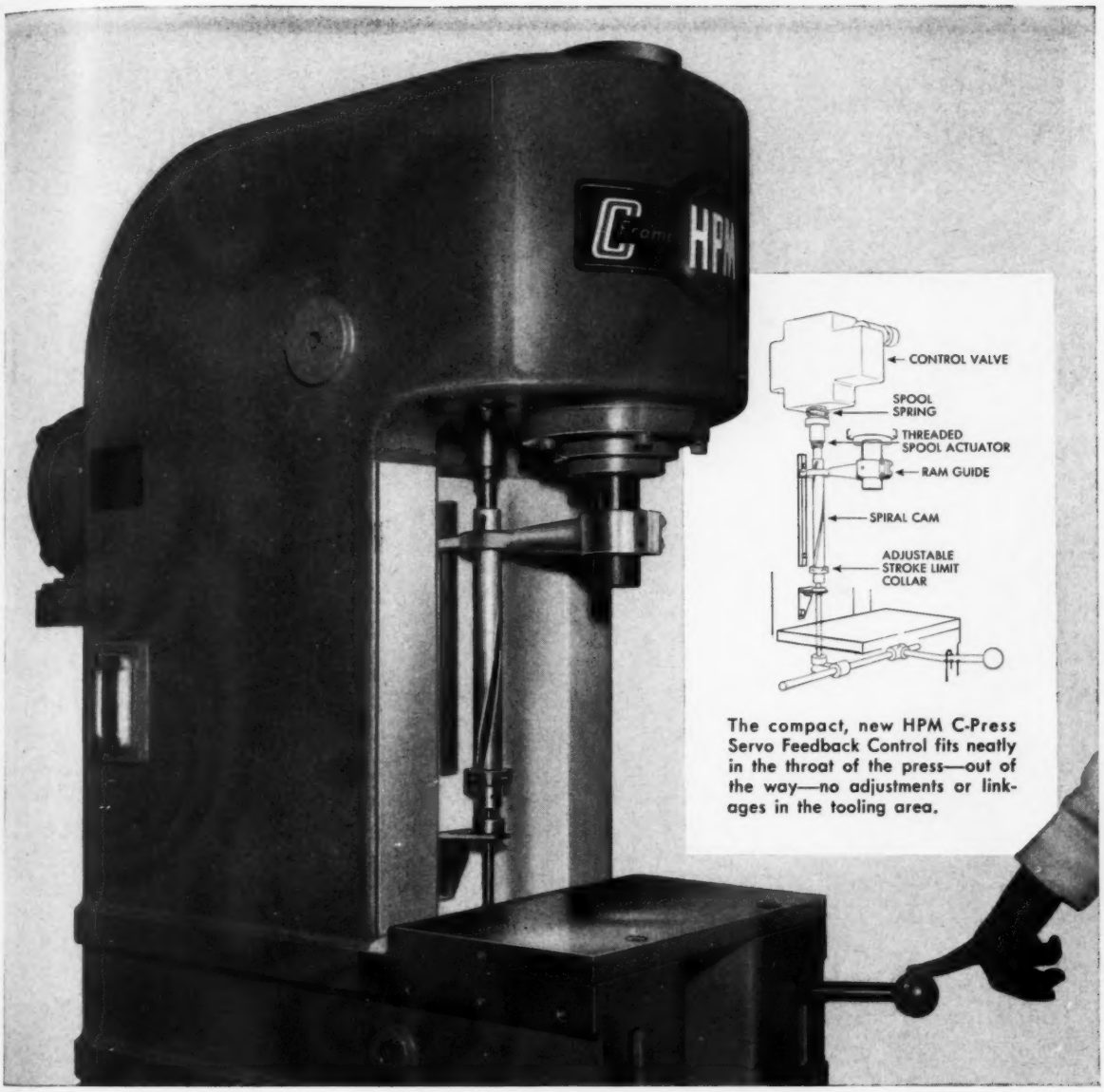
CIRCLE INFORM-A-GRAM KEY NO. 32



The compact, new HPM C-Press Servo Feedback Control fits neatly in the throat of the press—out of the way—no adjustments or linkages in the tooling area.

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INSTANT RESPONSE to the demand of the hand lever is featured in new Servo Controlled H-P-M C-Presses. The new system offers many advantages. Ram speed is directly proportionate to rate of lever control movement through a direct metering valve. The application of *force on work* is in direct response to movement of the control lever. The *position* of the ram is accurately controlled by the lever until the work is contacted. The pressure control then takes over and further lever movement increases pressure on the work. Releasing the lever will immediately decrease the pressure and then return the press ram to its adjustable up position. The downward travel of the press ram may be limited by means of the adjustable lower stop-collar.

This direct relationship between demand and response is accomplished by a unique, compact, spiral cam principle that meters oil to the cylinder in direct response to the action of the hand lever. For *straightening* operations it permits the operator to apply force on work to gauge readings — accurately and effectively. For *compacting* it permits rapid approach, slow pressing or bumping, repeat strokes if needed. *For lab or experimental work* where applied force must be carefully analyzed, the HPM C-Press offers many advantages.

Many production jobs may be improved through the use of this unique and versatile manual press line. Available in 5, 10 and 15 ton models. Get the complete details by asking for Bulletin H58CPM. Plan for more profits by planning with H-P-Ms.

HPM

THE HYDRAULIC PRESS MFG. COMPANY
A Division of Koehring Company, Mount Gilead, Ohio, U.S.A. H901

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NEW

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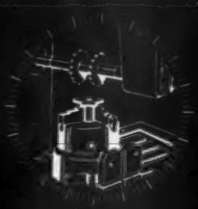
MASTER SPACER

with No. 0 Timken Bearings

gives increased production and optimum accuracy in



straddle milling

milling

jig drilling
with either micrometer or "Jo" block setting

inspection

Write for free catalog "Erickson Master Spacer" today. And at the same time request your copy of Catalog K you'll find cost-slashing applications for all Erickson holding tools.

The new Erickson Master Spacer quickly and accurately positions work for a wide variety of jobs. This *one* tool can eliminate expensive jigs and fixtures . . . makes it a simple procedure to set up drilling, milling, boring and special machining operations.

The new Erickson Master Spacer, ideal for tool room and production machining, assures outstanding performance under heavy helical cuts and slow feeds. *Indexing accuracy guaranteed within .001-inch cumulative error on a 6-inch diameter circle.* Jig drilling is possible with either micrometer or "Jo" block setting. Timken bearing construction permits work to be trued in position with brake off because spindle alignment remains unchanged.

The new Erickson Master Spacer can help you come to grips with your Number One Problem—high production costs. The first step is to get the Erickson story.

AA-3091

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EXPANDING MANDRELS • EXPANDING-COLLETS • SPECIAL HOLDING FIXTURES
CIRCLE INFORM-A-GRAM KEY NO. 34

ALPLY SANDWICH, ANYBODY

ONCE IN A BLUE MOON we venture to devote this page to the glorification of a new product. Our reasons have to be "pure" lest we be accused of going "commercial," or letting the advertising tail wag the editorial dog.

However, the importance of a startling technological development transcends more mundane considerations, so we are going to tell you of a new material or construction component which should be of such vital interest to manufacturers and users that the sooner the word gets around, the sooner its benefits can be explored, assessed, and reduced to practice.

We learned of this on the last day of 1958, which is another good reason for relaying the disclosure to you via this page. In "tooling up" each issue of Tooling & Production for production by the printer and delivery to you by Uncle Sam, the editorial is the last page on the typesetting schedule. So, when something hot comes along, the editor can become a short order cook in order to dish it out to you in a hurry. Can you think of a better reason for trifling with our editorial chastity?

Here's the dope: Simultaneously, Alcoa has announced the availability of a newly developed construction panel—a sandwich of expanded plastic beads between aluminum sheets — and Westinghouse announced that they are off to a running start with two refrigerator models constructed almost entirely from the unique new material.

Alcoa's development and Westinghouse's guinea-pigging represent about two years' effort.

The sandwich core is produced from expandable polystyrene beads. The beads form a white, opaque, and odorless foam material. The sandwiching of the foam core between sheets of aluminum develops a panel which possesses high strength, stiffness and dimensional stability, along with high insulating value. It has no food value for plant or animal life, is non-toxic and self-extinguishing.

Finish possibilities for the panel's aluminum skin are limitless. It can be textured, formed and colored by a variety of methods to achieve any desired decorative effect.

The panels can be cut, mitered and tenoned, preparatory to bending, on ordinary woodworking machines — even those of the home workshop class.

This kind of tooling — sawing and mitering fixtures, drilling guides and forming templates — is not yet comparable in productivity to metal stamping presses and welding fixtures, but it does mean that short runs and prototypes can be produced at a fraction of the cost of conventional tooling. And, as always follows, tooling costs will come down as more and more markets and applications are imagineered.

Alcoa has developed new production methods which result in the panels being made in widths up to 4′, of unlimited length, and a thickness range of 1″ to 6″.

Such physicals for a new material are a market researcher's dream — he can really let himself go!

In the domestic refrigerator field, it, at one fell swoop, makes economical the limited, custom-built, fabrication of units which conform to the rest of the kitchen's table-top-height convenience of dishwashers and other working-space cabinetry. In fact, one of the two Westinghouse new models made of Alply is a 13 cu ft refrigerator-freezer which can serve as a built-in or counter-top unit.

The simple fabricating operations applicable to Alply mean that the skilled do-it-yourselfer can come up with specially contoured refrigerator to fit that kitchen nook where no production job can be positioned. If he refuses, he can, forthwith, make an Alply, decorated and insulated doghouse for himself — and dog.

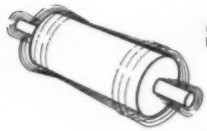
Rest assured we will be hearing more about Alply in such fields as home construction and remodelling, trailers, and industrial construction, to say nothing of its applicability to products that didn't exist before — another boost to our standard of living.

And next month we will have some Westinghouse-Alply tooling and fabrication know-how and show-how pictures for you.

E. Willard Pennington

Editor

Why GISHOLT BALANCING stresses "plane separation"



Take this typical part: when you rotate it at high speed, any unbalance effect at one point—or plane—has a "cross effect" in another. If you don't have proper means for separating these unbalance effects in two correction planes, then your balancing job becomes a tedious, time-wasting job of trial and error. And you're never quite sure.

Gisholt Balancers provide plane separation by means of electrical networks. They enable you to use whatever correction planes are most convenient on your specific parts. They let you measure unbalance directly in correction units. They give you the most sensitive, accurate means ever devised—capable of measuring vibratory movement of at least .000025 inch. Gisholts are faster, easier to operate, easier to read. And they make it easy for you to be *sure.*

To have less than these advantages is to add to your costs in other ways—in time, loss of accuracy and inferior balancing standards. Ask us to send the Gisholt Balancing Catalog.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

DYNETRIC BALANCERS

TURRET LATHES · AUTOMATIC LATHES · SUPERFINISHERS · BALANCERS · SPECIAL MACHINES

CIRCLE INFORM-A-GRAM KEY NO. 36

TOOLING & PRODUCTION Magazine

TOOL EVALUATION

Based on a

MERIT-TOOL PERFORMANCE RANGE

AT A TIME WHEN A MULTIPLICITY OF CUTTING TOOL MATERIALS is in existence and more are constantly under development, the job of tool evaluation becomes increasingly complex. Not only do we have to know the tool life, wear properties, etc., but we must know also the whole "Merit-Tool Performance Range" of a given cutting tool material, when machining a variety of materials.

Only by knowing the tool performance range: that is, tool life, breakdown point and relative order of performance of cutting materials, can we expect to properly evaluate the tool performance of existing tool materials, improve them, and direct our efforts in the correct channels to develop new cutting tool materials.

The development of high strength super alloys and high temperature alloys which have been rated partially machinable or even non-machinable, has added increasing importance to the tool evaluation program.

By graphing several of the *cutting speed-tool life* values as a function of the range of performance and the breakdown points, a true *merit-tool performance range* for tool materials is established. Once this range of performance is set, the job of tool evaluation is greatly simplified and the merits of any tool material graphed is immediately evident. Duplications in performance can be eliminated, areas where improvements in tool materials are needed are discovered, and the correct applications of these tools are delineated.

by Francis Cellier
Chief Engineer
Research Testing
FIRTH STERLING INC.
Pittsburgh, Pa.

Tool Evaluation

In order to understand the principles involved in establishing a *merit-tool performance range* for tool materials, a knowledge of the most basic method of tool evaluation, the *cutting speed-tool life* test, is necessary.

Ever since Frederick W. Taylor conducted tool life tests by basing the life of a cutting tool on a specific time, tool performance evaluation has been of great concern. Taylor's method was to run cutting tests under standard cutting conditions and base tool performance on the cutting speed which would produce complete failure in twenty minutes. Although more practical methods have since been devised, Taylor is still the "father" of tool life testing.

The most popular practical standard of tool evaluation has been the relationship of cutting speed and tool life which employs the general formula: $VT^n = C_t$ where

- V = the cutting speed in feet per minute
- T = the tool life or duration of the cut
- n = the slope of the straight line on log-log graph paper
- C_t = a constant depending on the cutting condition which equals the cutting speed for a tool life of 1 minute.

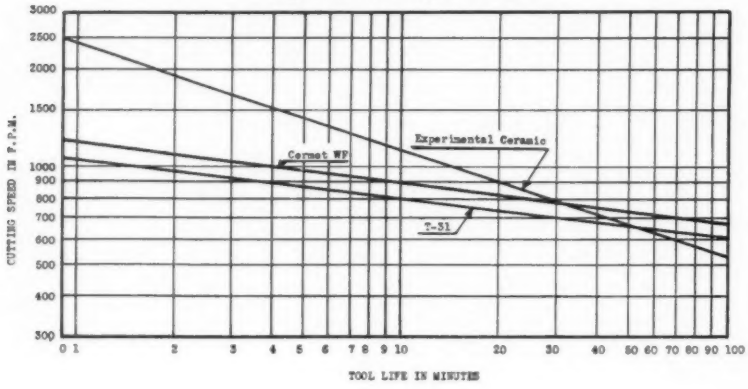
The cutting speed-tool life relationship is based not on crater wear but on the flank wear of the cutting tool, measured from the original cutting edge. An evaluation based on crater wear has been found to be much less consistent. In measuring the width of flank wear, which is linear with cutting time after the first few minutes, eventually a critical point (generally 0.030") is reached where wear either accelerates rapidly or complete failure of the cutting tool occurs.

In Figure 1 is shown a typical *cutting speed-tool life* graph of a test conducted in the evaluation of three different Firth Sterling cutting tool materials used in a turning test. This test is one of many similar tests conducted in the course of tool evaluation of standard cutting tool materials and new cutting tool materials.

The information obtained from the *cutting speed-tool life* tests as shown in Figure 1 is revealing. It gives the cutting speed obtainable over a large range of tool life, indicated by V_{10}, V_{60}, or any other tool life desired, to a point where cutting speed is too low for the particular tool material and failure occurs. Then the relative order of performance is established and the percentage difference in tool performance can easily be computed, based on *cutting speed-tool life.*

The slope "n" of the *cutting speed-tool life* line is significant because it measures the sensitivity of the tool material to abrasion and tool temperature. When a reduced slope is obtained, such as with the sintered carbide shown in Figure 1, the tool is predominantly affected

Fig. 1. CUTTING SPEED - TOOL LIFE TESTS



Test Log . . . . .AISI 4140	Tool Geometry	0°	Back Rake
Depth of Cut . .0.0625"		0°	Side Rake
Type of Test . .Finishing		6°	End Relief
BHN 269		6°	Side Relief
Feed . . . . . .0.010"		15°	End Cutting Edge Angle
Holder BRC-20		15°	Side Cutting Edge Angle
		3/64"	Nose Radius

$VT^n = C_t$

Grade	C_t	n	V10	V60
Experimental Ceramic	2425	.280	1120	633
Firthite Cermet WF	1200	.124	900	720
Firthite T-31	1060	.119	800	647

by cutting temperature. A very steep slope, generally above 15° to the horizontal, is an indication of predominant sensitivity to abrasion and may be accompanied by progressive chipping. An example of this is the tool life line obtained with the Firthite experimental ceramic.

Cutting speed-tool life data are, basically, measures of tool wear. The cutting forces resulting from the size cut involved must be less than the mechanical strength of the tool materials under test. Otherwise an erroneous measure of *cutting speed-tool life* is obtained due to macro-chipping, as opposed to micro-chipping, which is associated with normal progressive wear on the tool flank. Macro-chipping is characterized by large chips at the cutting edges, causing premature failure, and is not a measure of wear resistance but of mechanical strength. However, here the range of performance is not evident: only the performance at a specific cut is shown.

In Figures 2, 3, and 4, the standard *cutting speed-tool life* performance of five Firthite steel-cutting carbide grades is shown. Tool life lines are averages of an extensive number of standard tests, in some cases as many as thirty-five. The grades in Figure 2 are used for finishing to medium roughing applications; those in Figure 3 for finishing to roughing; and those in Figure 4 for finishing to heavy roughing.

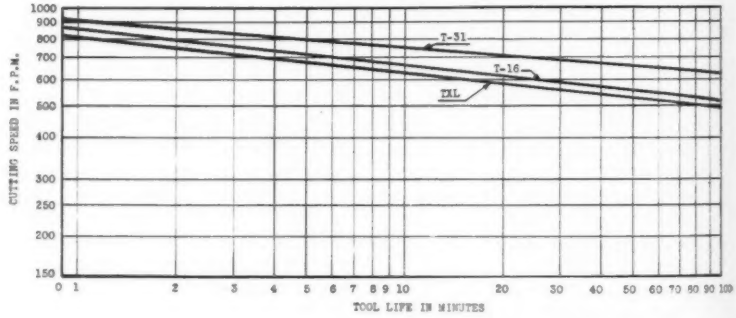
It should be noted that as the size cut increases in the tests from Figure 2 to Figure 4 some grades are dropped and others are introduced. This is dependent upon the properties of the grades and their intended use.

Since each grade is designed for a certain range of application, the physical properties and chemical analyses are controlled so that maximum *cutting speed-tool life* is achieved for the intended range of applications. For example, cermet grade WF, Figure 1, has the highest *cutting speed-tool life* value, V_{60} 720. This material was designed specifically for high speed, light finishing applications where excellent wear and high cutting temperature resistance are the norm. In order to achieve this aim, cutting strength is partially sacrificed for extremely high wear and temperature resistance. On the other hand, although cutting strength is sacrificed, the intended application for light finishing cuts run high speeds does not require great strength.

Although these are not the only requirements of a cutting tool material, and it may be an oversimplification, it is used as an illustration. Grade WF was not tested under the conditions of the general purpose test because it was not designed for this application and would have broken down under the cutting forces encountered.

The question then arises, at exactly what size of cut will break-

Fig. 2. CUTTING SPEED - TOOL LIFE TESTS



Test Log . . . . .AISI 4140	Tool Geometry	0°	Back Rake
Depth of Cut . .0.0625"		0°	Side Rake
Type of Test . .Finishing		6°	End Relief
BHN 285		6°	Side Relief
Feed . . . . . .0.010"		15°	End Cutting Edge Angle
Holder BRC-20		15°	Side Cutting Edge Angle
		3/64"	Nose Radius

$VT^n = C_t$

Grade	C_t	n	V10	V60
Firthite T-31	910	.084	753	647
Firthite T-16	860	.137	663	550
Firthite TXL	810	.139	625	520

down of the tool occur, so that this point may be graphed and the range of performance established.

We see, then, that obtaining the *cutting speed-tool life* of a tool material based on wear properties under specific conditions is one thing. But obtaining a true *merit-tool performance range* of the same tool, so that the limits of performance are determined, is considerably more desirable. On the other hand, a range of performance graph cannot be made until conventional tests have been run as a basis.

To find the ultimate breakdown point of a cutting grade by conventional methods, especially when two or more tool materials are being compared for tool performance, the size of the cut would have to be increased by steps and a tool life test performed each time. This is impractical, extremely costly, and time consuming.

Merit-Tool Performance Range

To obtain a *merit-tool performance range* of a cutting tool material, the *cutting speed-tool life* values (V_{60}) obtained in the tests shown in Figures 1 through 4 are graphed as a function of the Tool Performance Range, Figure 5. The Performance Range is based on the size cut, and is shown on the graph (abscissa) in scale, as increasing depth of cut and feed.

The V_{60}, plotted as the Order of Merit (ordinate), is abritrarily chosen. It could be V_{10}, V_{20}, or any other desired tool life. However the V_{60} is more often chosen as the index of *cutting speed-tool life*.

The Tool Performance Range (abscissa) is divided into three ranges in a proportion of 5, 2, 1 for roughing, general purpose, and finishing respectively. This proportion is based on the field of application of cutting tool materials for the three different classes of cut. The vertical dotted lines on the chart denote the lines of demarcation between the three classes of cuts. These lines of demarcation project from the size cut used for the *cutting speed-tool life* graphs (Figs. 1 through 4).

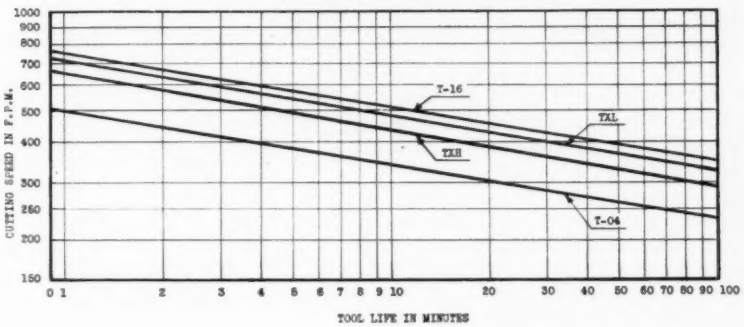
The V_{60} values obtained from these graphs for each tool material are plotted at these lines of demarcation. By connecting points, part of the *merit-tool performance range* curve is generated for each tool material.

For example, Firthite grade TXL was tested under three different cutting conditions (Figs. 2, 3, and 4) and these V_{60} values were plotted on the *merit-tool performance range* chart. Intermediate points can be checked, if desired, by conducting additional *cutting speed-tool life* tests, to improve the accuracy of the curve.

It then remains to project the curve to the breakdown point.

To obtain the breakdown point, a separate cutting test is necessary. The values shown in Figure 5 were based on the size cut, as indicated, where breakdown of the tool occurred, and are actual breakdown points. If all grades are run in the same test, as was done here, a rel-

Fig. 3. CUTTING SPEED - TOOL LIFE TESTS



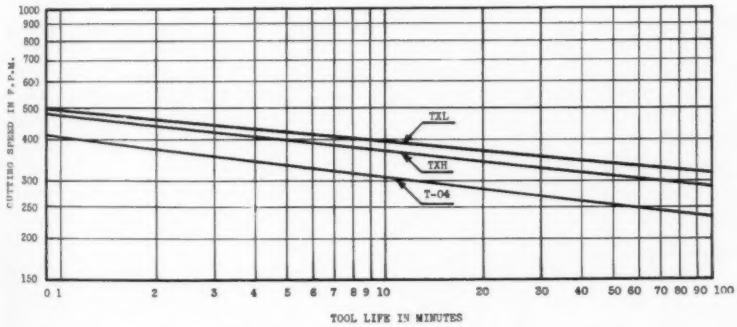
Test Log . . . . .AISI 4140
Depth of Cut . .0.125″
Type of Test . .General Purpose
BHN 265
Feed . . . . . .0.020″
Holder BRC-20

Tool Geometry 0° Back Rake
0° Side Rake
6° End Relief
6° Side Relief
15° End Cutting Edge Angle
15° Side Cutting Edge Angle
3/64″ Nose Radius

$VT^n = C_t$

Grade	C_t	n	V10	V60
Firthite T-16	744	.139	510	380
Firthite TXL	702	.168	480	355
Firthite TXH	632	.167	432	320
Firthite T-04	497	.162	340	254

Fig. 4. CUTTING SPEED - TOOL LIFE TESTS



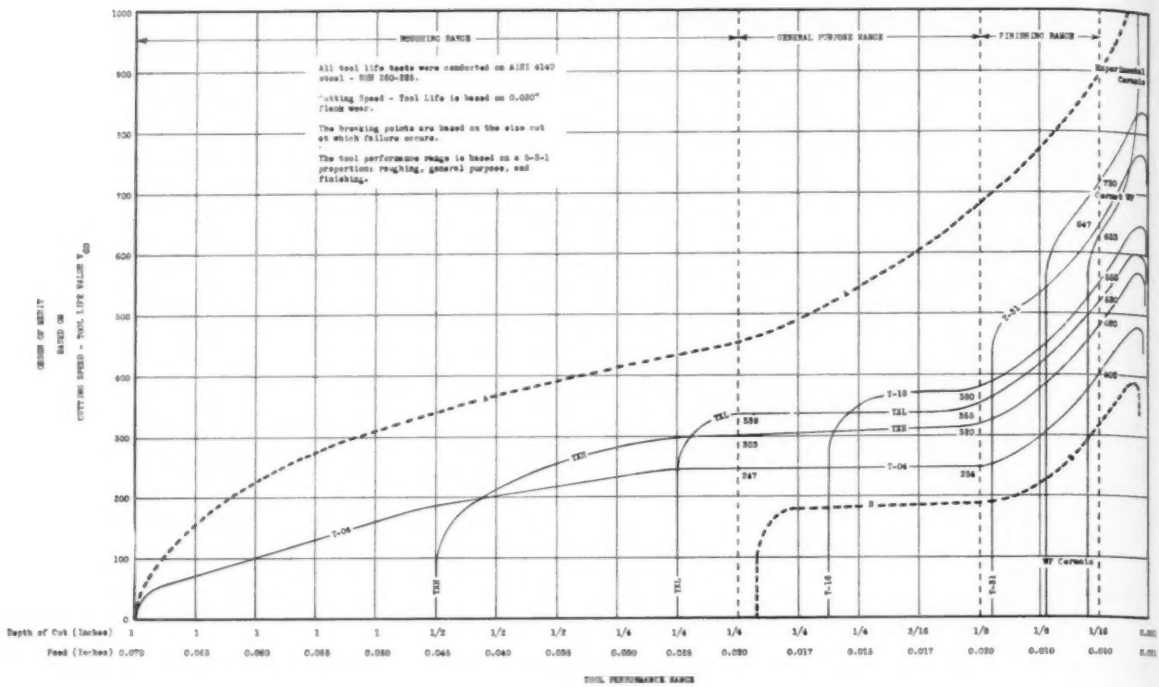
Test Log . . . . .AISI 4140
Depth of Cut . .0.250″
Type of Test . .Roughing
BHN 265
Feed . . . . . .0.020″
Holder BRC-20

Tool Geometry 0° Back Rake
0° Side Rake
6° End Relief
6° Side Relief
15° End Cutting Edge Angle
15° Side Cutting Edge Angle
3/64″ Nose Radius

$VT^n = C_t$

Grade	C_t	n	V10	V60
Firthite TXL	500	.091	398	338
Firthite TXH	470	.108	368	303
Firthite T-04	410	.125	309	247

Fig. 5. MERIT - PERFORMANCE RANGE CHART


ROUGHING RANGE
GENERAL PURPOSE RANGE
FINISHING RANGE
All tool life tests were conducted on AISI 4140 steel - BHN 280-320.
Cutting Speed - Tool Life is based on 0.020" flank wear.
The breaking points are based on the size cut at which failure occurs.
The tool performance range is based on a 5-3-1 proportion: roughing, general purpose, and finishing.
ORDER OF MERIT RATED ON CUTTING SPEED - TOOL LIFE VALUE V60
Experimental Ceramic
730
Cermet WF
647
635
568
550
530
T-31
T-16
580
565
T-04
394
WF Ceramic
T-06
TXD
TXL
538
503
247
B
Depth of Cut (Inches) 1 1 1 1 1 1/2 1/2 1/2 1/4 1/4 1/4 1/4 1/4 3/16 1/8 1/8 1/16
Feed (Inches) 0.070 0.065 0.060 0.055 0.050 0.045 0.040 0.035 0.030 0.025 0.020 0.017 0.015 0.017 0.020 0.010 0.010
TOOL PERFORMANCE RANGE

ative range of performance is obtained.

Three types of breakdown test have been used with success to find the ultimate breakdown point:

1. By increasing the depth of cut and feed, under constant cutting speed, until total destruction of the cutting tip occurs. Increases in the size cut are made at short cutting time intervals, usually 1/2 minute.

2. Keeping all cutting conditions constant, with the exception of feed, feed is increased at 0.005" intervals until breakdown occurs. Suggested cutting time is 1/2 minute at each feed setting.

3. Keeping all cutting conditions constant, and decreasing the lip angle at the cutting edges, thereby weakening the cutting edges. This can be done by increasing the end and side relief angles gradually until breakdown of the cutting tip occurs.

The first of these was employed for the breakdown points in Figure 5. To trace some of the performances, starting from the finishing range of application at the extreme right side (Fig. 5), we see that the V_{60} values decrease as the cut size increases until a point is reached where the tool breaks down due to heavy cutting forces.

The grades performing best in the finishing range of performance were designed especially for high speed, light finishing applications where excellent wear as well as high temperature resistance are a prerequisite. A good example of this is the experimental ceramic which has these attributes, but which breaks down very rapidly at an only slightly heavier cut due to low transverse rupture strength.

It should also be noted that the ceramic does not follow the same type of curve as do the other cutting materials shown. This is due to the extreme slope ("n") obtained with ceramics in the *cutting speed-tool life* evaluations, and demonstrates again that differences in tool behavior that are revealed on the *cutting speed-tool life* charts are accurately portrayed in the *merit-tool performance range* chart as well.

Cermet Performance Plotted, Too

The Cermet WF, which has the same type of curve as the carbides, covers a much wider range of application before breakdown occurs than does the ceramic, but runs at very high speeds as well.

Progressing to the next larger cut: where Cermet WF breaks down grade T-31 takes over, followed by T-16, TXL, and so on throughout the chart. In this manner the whole tool performance range is covered by cutting tool materials. For each size cut shown, there is one grade which has the highest Order of Merit. The *merit-tool performance range* of each cutting tool material is clearly indicated, revealing weak points in performance, overlapping performance, and directions of further development.

The gaps between grade curves should be examined: namely, the points where one tool breaks down and the next takes over. These spots are as interesting in any tool comparison as are the curves themhave any specialized application, it which a decision is made to develop or not develop grades of intermediate performance. Cermet WF is an excellent example of a grade recently developed to fill an outstanding gap which the chart shows formerly existed between the stronger carbides and the very brittle but very high speed ceramics.

At the present time, the development of cutting tool materials has grown into a science whereby grades can be created at will to perform over a specific range. However, to develop materials which give the best performance in small ranges of application would lead to an infinite number of grades that overlap, a situation which would be revealed on the chart to be wasteful as well as being confusing to everyone.

The dotted curve "B", for example, although exaggerated, could be a cutting tool material in use or under evaluation. It is clearly evident from the chart that if this were a steel-cutting tool material that did not have any specialized applicaion, it

would have no merit because it is outperformed both in cutting speed and breakdown point along its entire tool performance range.

The illustrative dotted curve "A" is an ideal tool material very much desired but, unfortunately, unlikely of attainment. Such a material, having the degree of wear resistance and cutting strength shown, would outperform all of the other tool materials, making them obsolete.

Therefore, it can be seen what a wealth of information, even in the hypothetical realm, can be derived from establishing such a *merit-tool performance range* chart as has been outlined.

The same type of *merit-tool performance range* data has been charted in the tool evaluation of cast iron-cutting tool materials with the same degree of success.

Super Alloys Demand Tool Studies

In the present era of super alloys and high temperature alloys which, in some cases, are classed as non-machinable, the importance of being able to evaluate the merits of a tool material is self-evident.

It must be realized that these alloys present a completely different problem in machining from conventional steels or cast iron. Here, with many of these alloys, especially those having more than 25% Ni or Co in their composition, chemical reaction between the workpiece and the tool occurs with most tool materials. Machining is not only a problem of wear resistance and cutting strength. A relative order of tool performance obtained from steel- or cast iron-cutting data is, in most cases, completely misleading when machining these alloys. However, by knowing and graphing the *merit-tool performance range* of existing cutting tool materials, insight will be gained as to further channels of development for new cutting tool materials.

Manufacturers confronted with the machining of these alloys are coming to the conclusion that the difficulties involved do not stem from the machine tools, machining method or application, but that the difficulties result from the deficiencies in the present-day cutting tool materials themselves. The problem then resolves itself into one of being able to metallurgically develop suitable cutting tool materials, chemically inert to the workpiece, with improved wear resistance and cutting strength.

At each step of the way the *merit-tool performance ranges* must be charted to direct the aims of new research developments.

Previous attempts to represent the tool performance range of cutting tool materials, especially those made by cutting tool producers, have taken the form of bar graphs, overlapping circles to show areas of application, *hardness-strength* directional charts, *cutting speed-tool life* graphs, and others. However, none of these have actually portrayed the *merit-tool performance range* of a tool material. At best these methods have merely indicated directions of application—none have defined the actual limits of the performance range of each tool material.

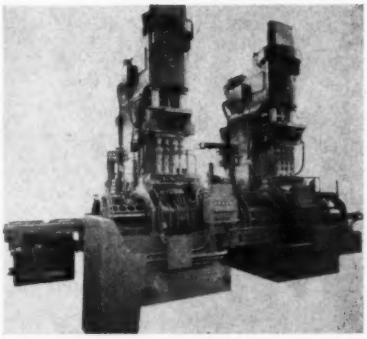
Graphing the *cutting speed-tool life* as the function of the range of performance and breakdown points clearly defines the limits of application of each tool material under examination, and portrays these performances relative to each other.

SYNCHRONIZED HONING MACHINES ACCURATELY HONE ENGINE BLOCKS

Automatic honing of the bores of two different cast iron truck motor V-8 cylinder blocks is being performed on two Barnesdril standard vertical-type honing machines. Placed side by side, they're connected by a synchronized automatic trunnion and transfer type fixture. Electrical interlocks and probe furnish maximum safety in setup and operation.

While in operation, the operator only replaces worn out honing stones, as directed by signal lights on the control panel. He also manually moves the part on the conveyor into the pre-loading station. A sensing device in the pre-loading station starts the automatic work cycle of transfer, load, clamp, trunnion, hone, return trunnion, and unclamp.

As the cylinder block placed in pre-loading Station 1 is moved into Station 2 and located in the fixture by pins engaging in dowel holes in the pan face, it is hydraulically clamped and rotated to place the left bank of bores vertically in the



honing position. Simultaneously, a part in Station 5 has been rotated in the opposite direction to hone the right bank of bores.

During normal operation, there are six blocks in the machine; one in pre-load Station 1, one in each of Stations 2 and 5, one in idle Stations 3 and 4, and one in eject Station 6.

These machines are each equipped with automatic bore sizing, 20″ hydraulic spindle stroke and one 4-spindle auxiliary head. The auxiliary heads are arranged with pneumatic hone expansion which features automatic rapid expansion and collapse and automatic compensation for stone wear. Pneumatic hone expansion and proper stone selection facilitates the removal of 0.004″ to 0.005″ stock in less than 30 sec.

Production is 85 parts/hr gross. Bore sizes, after honing, are consistently within 0.0005″ from bore to bore of the specified diameters and geometrically accurate within 0.0005″ for taper and 0.0005″ for out-of-round. Surface finish is maintained at 35 rms with an allowable range of 24-40 rms.

Aluminum Company of America now supplies bundles of screw machine stock consisting entirely of 12′ lengths. This 12′ "specific length" stock costs no more than the standard length material, and rod in rounds up to 2¾″ dia, and hexagons up to 2″, are available.

WHEN IS GRINDING NOT GRINDING?

Answer to title question: When material is removed with electrolytic action. Instead of grinding the workpiece (100% abrasion) work is done by a combination of electrolysis (90%) and abrasion (10%) to provide rapid stock removal **and** a fine finish (10 rms or better).

by William E. Hoffman
Associate Editor

WHEN GRINDING CARBIDES, ELECTROLYTICALLY, the metal-bonded diamond wheel barely touches the workpiece. In theory, the cutting edges of the wheel merely clear away the "debris" (material removed) to maintain clearance between the wheel and the work. Proper clearance is important in order that amperage-carrying coolant can properly attack the work.

Some advantages over former carbide grinding methods are: a much faster material removal; an almost fantastic reduction in wheel wear; and a virtual elimination of cracking, chipping, or burning of the carbide. Also, there is relief to the operator from having to force the tool against the grinding wheel, manually—although this is not necessary in all grinding setups. Another advantage of major import is the elimination of one operation. Previously, carbide grinding was done in two operations.

Before the advent of electrolytic grinding, it was necessary to first take a rough cut with a silicon carbide wheel and then finish with a diamond wheel. Electrolytically, the entire job can be done, to a finer micro-finish, with one wheel.

In the Structures Works, of the Tapco Group, Thompson Ramo Wooldridge Inc., a diamond wheel grinding carbides by *conventional* methods, lasted about a month. Now with the adaption of electrolytic power they are experiencing unbelievable life from their wheels, on the same job. In one instance, a face wheel on a Hammond Grinder went into service some months ago, and judging from past performance it will still give many months of service.

An interesting innovation has been added to the machine shown in Figure 1. Besides the automatic oscillation of the wheel-head, a table power-feed has been added. The operator merely presets the power-feed control knob for the thousandths he wants to remove. While grinding is being done, automatically, he is free to attend to checking, inspection, marking and setup duties.

As a further refinement, Mr. Inteso, Design Engineer on this work at Tapco, has added pressure relief valves. Their addition permits manual table operation when desired. Also, for the purpose of obtaining data, a standard depth indicator-gage was added. This tells how many thousandths have been removed at any time during a grinding operation.

Enough with the adjectives—let's make with the figures: Following are cost comparison figures comparing *conventional* carbide grinding methods with the grinding of carbides *electrolytically*. Report is based on a total of 14 cu in of carbide removed. The very same operation was done with both conven-

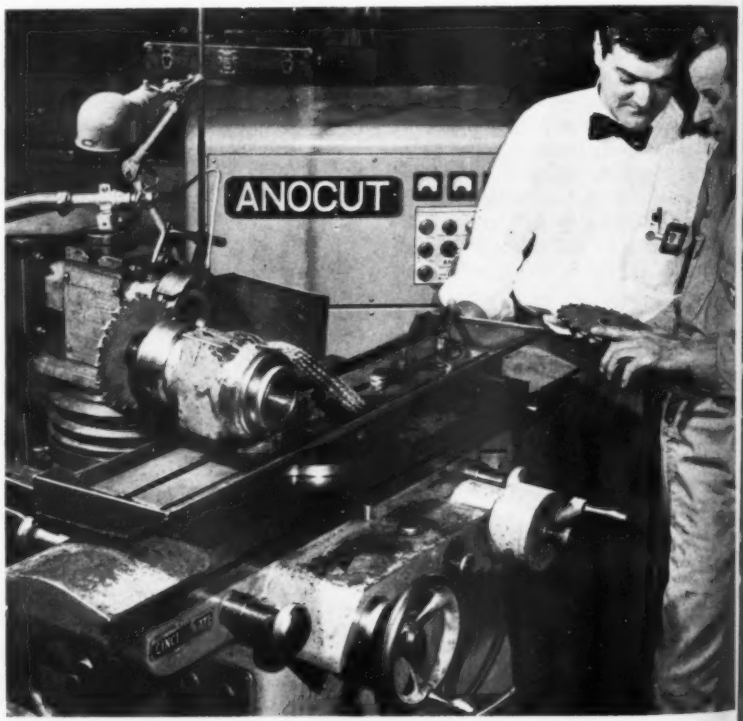


Fig. 1. Inspection of a carbide tip cutter after an electrolytic grind on a Cincinnati. A metal bonded diamond wheel is used.

Fig. 2. Shown here is the Hammond grinder mentioned in the text. It's equipped with an oscillating head, a power-feed-table, an Anocut power pack and other innovations discussed herein.

tional and electrolytic grinding for this report.

Abrasive Cost Reduction—Offhand Grinding Figure 2.

Conventional Grinding
$6.63/cu in of carbide removed (green grit then diamond wheel)

Electrolytic Grinding
$1.60/cu in of carbide removed (diamond wheel only)

Abrasive cost reduction due to switch was approximately 75% or a savings of $5.00/cu in of carbide removed. In addition the removal rate was increased 1.84 times.

end

We, the editors, know of no other way to achieve savings like this in grinding. Do you know of any? If you, the reader, are able to serve Industry with cost saving methods, *in any area of tooling and production*, may we pass your ideas on for you?

ELECTROLYTIC GRINDING AT TIMKEN ROLLER BEARING

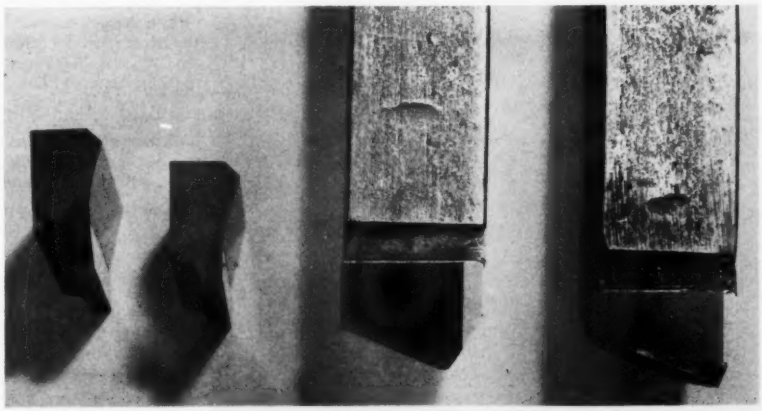
visited by
E. Willard Pennington
Editor

THE USE OF CARBIDE CUTTING TOOLS in the automatic screw machine departments of The Timken Roller Bearing Company in Canton, Ohio, increased considerably during the past several years. Correspondingly, the consumption of expensive diamond wheels used for the grinding of these tools became greater. This grinding cost has been alleviated in certain areas with the introduction of the electrolytic process.

In the carbide tool grinding department of the Timken Gambrinus plant an Anocut 300 ampere unit has been combined with a Porter-McLeod cutoff machine and a 6" x 18" Norton surface grinder. The surface grinder is used to grind chip breakers on cutoff, turn, bore and breakdown tools.

A complete chip breaker is ground on the tool with one pass of the

Fig. 1. Examples of electrolytic carbide-grinding applications at Timken. Left to right: A shattered solid carbide insert and the salvaged and re-useable insert after cutting off the broken end. Next, a turning tool with a chip breaker; grinding time 7 sec. vs the 25-30 sec. previously required. Right, a turning tool showing the punishment the cutting edge takes when no chip breaker is provided.



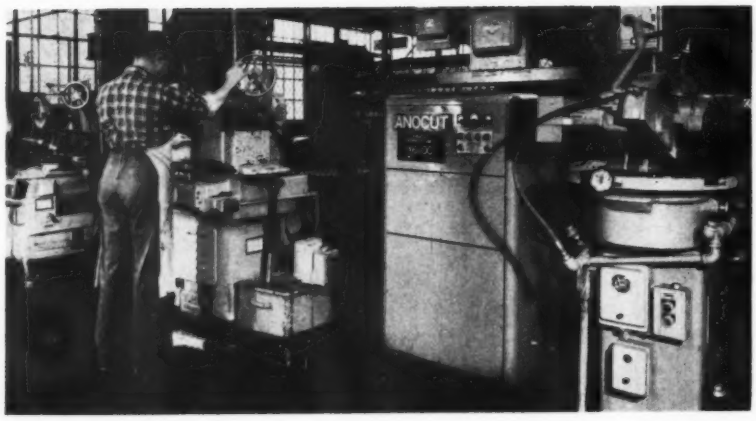


Fig. 2. In this Timken Department, both the Norton surface grinder and the Porter-McLeod cutoff machine are powered (for alternate use) by the one Anocut power supply.

grinding wheel. It is usually to a depth of .018″ to .020″ and to a width ranging from .045″ to .080″ depending upon the tool application. The metal bond diamond grinding wheel used is 3/16″ wide, 8″ in diameter, 150 grit and 100 concentration. Since it is only possible to use one side of the wheel at a time, a reversible adapter is used so that both sides of the grinding wheel can be utilized before wheel dressing is required. It has been determined for this particular application that the best results are obtained with the Anocut power set at 7½ volts which produces a surface finish of 5 to 10 micro-inches. The rate of feed is controlled so that the unit normally operates with 100 to 150 amperes.

Chip breaker dimensions are considered vital for the control of chips which directly affect tool life, therefore, they are held to close tolerances and carefully inspected 100 per cent on a Kodak contour projector.

Prior to the introduction of the electrolytic process, chip breakers were ground on grinders using conventional vitrified bonded diamond wheels. The grinding cycle was 25 to 30 seconds and excessive chipping and flaking of the carbide edge was apparent. With the use of electrolytic grinding the grinding cycle is 7 seconds and chipping and flaking of the cutting edges has been reduced considerably. Grinding wheel use has also been reduced by a ratio of 7 to 1.

Due to the nature of electrolytic grinding, the grinding wheel merely assists in the removal of the carbide, hence exerting little pressure on the spindle and bearings, which minimizes maintenance. With the previous method, the constant pressure made it necessary to repair both spindles and bearings frequently since a high degree of accuracy was essential. In the two years-plus that the electrolytic grinding method has been in use only minor service has been required on the power supply unit and the surface grinder. Maintenance economy has proved an important "plus factor" since the machine is run 24 hours per day.

The coolant solution which conducts the current between the diamond wheel and the carbide is a mixture of four pounds of electrolytic salt to five gallons of water. The mist from this solution is collected at the point of grinding contact and returned to the supply tank.

The Porter-McLeod cutoff machine completes the first step in the salvage of solid carbide tools, that is, cutting off the broken end. Because of their design, some of the solid carbide tools are expensive; and being able to cut off the damaged end affords a considerable savings. The cutoff machine is attached to the same power supply unit as the surface grinder and therefore cannot be operated at the same time. The cutoff machine is used periodically when enough solid carbide tools of salvageable size have accumulated.

The Canton plant of the Timken Company has a second Anocut power unit in operation in conjunction with a Hammond oscillating carbide tool grinder. This unit completes in one setup the rough and finish grinds on carbide-tipped tools. At the present time only tools with a single cutting edge where the profile and point location are not critical are ground on this machine. Most common are tools used for turning, boring and chamfering. On this operation it has been determined that this unit operates most efficiently with a setting of 7 to 9 volts at a load of 200 to 240 amperes and with a grinding wheel oscillation of 60 to 70 per minute.

Previously, this grinding operation was performed by rough grinding on a machine equipped with a silicon carbide wheel followed by a finish grind on a machine with a diamond lap wheel. Two important advantages have been gained by using the electrolytic process. First, the complete grinding is done in one operation with one setup. Second, diamond grinding wheel use has been reduced by a ratio of 7 to 1.

The successful application of electrolytic grinding of carbide tools at the Canton and Gambrinus plants has resulted in the Timken Company installing additional units for use in the carbide tool grinding departments of its other bearing plants. end

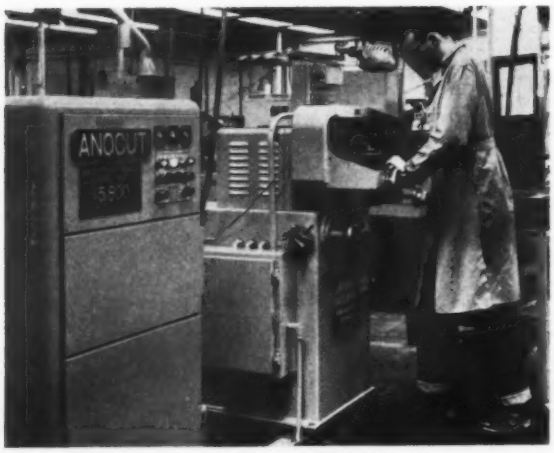


Fig. 3. On this Anocut powered Hammond oscillating carbide tool grinder, the "rough and finish" grind is attained in one operation. or such grinding the power pack is set to deliver 200 to 240 amps at 7 to 9 volts.

Editor's Note — This article's several pictures show Timken's practice of placarding their machine tools and equipment with the purchase price. Timken has found this a valuable assist in employee relations. First, when the plant has an employee open house, the youngsters can see that daddy is the boss of a machine costing thousands of dollars. Second, it serves as a constant reminder to the machine operators as to what it costs in capital goods to create jobs. **E.W.P.**

CARBIDE TOOL HOUSEKEEPING

How it can pay off in higher output, longer tool life, better finish, when procedures are properly organized.

by Antoni Niedzwiedzki
Carbide Tool Consultant
Detroit, Michigan

THIS REPORT TRIES TO GIVE A PICTURE of an ideal organization for carbide tool application, which allows, at the same time, the biggest tool output, the longest tool life, as well as the closest dimensional tolerances and the best surface finish of the machined work. Carbide tools are not only more wear resistant, but also, unfortunately, much more delicate than the high speed steel tools. The recommended procedures must be, therefore, followed with care.

The tool selection and design must be established in the manufacturing engineering department and must follow the specifications of plant or national tool standards as closely as possible. The number of the tools in common use should also be limited, in order to permit fuller tool stocks in every type.

From Tool Crib to Operator and Back!

It also is recommended to let the tools remain in custody of the tool crib and not of the particular operators, who borrow the tools indicated on their process sheets. The worn tools have to be exchanged, in the tool crib, against the new ones. Individual rework or resharpening of tools by operators or setup men is entirely abolished. All carbide tools should be ground either in the toolroom or in the grinding or resharpening room, attached to the tool crib. All new or resharpened tools, and all worn tools should be inspected, both to ensure the quality of the tools supplied and to pick up and to cure any industrial illness, in the form of trouble in the tool application. Thus carbide trouble shooting should be done preferably by a tool inspector attached to the tool crib. His activity might be helped by the use of special tool survey slips and should be supervised by the machining engineer, preferably attached to the manufacturing engineering department.

Modern manufacturing methods include as detailed a job preparation in the manufacturing engineering department as possible. The machine shop has only the task of an exact application of detailed manufacturing instructions. These should be clear and free of ambiguity.

Standards Assure Best Tools for Job

Details of very common application in the production routine are called standards. We have different standards; standard tools, standard practice instructions, all describing what for a common purpose has been found best. The existence of standard tools and standard practice instructions reduces and simplifies the work of the process and methods analysts.

Any machining operation should be performed with the tool best suited, both in its design and in its application. It must, therefore, be assured that the tool used be correct in its dimensions, shape, carbide grade, etc.

The people involved must have catalogs, or standard sheets in order to always specify the same tools in the same way. Further they must know the different equivalents of carbide grades, their symbols and marking colors. The inspection of any resharpened tool makes sure that its shape is repeatedly reproduced in the same correct way to ensure that constant machining conditions may be possible. We must, therefore, not only select the best suited tool, but also make sure that it is used.

Modern machining practice does not allow the machine tool operators either to select their tools themselves, or to regrind, to arrange, or in any way to modify them. The holding of these necessary conditions is only possible if the recommendations in this report are followed by all persons involved.

As the present report deals chiefly with the organization of a good carbide tool housekeeping policy in the plant, we do not intend to discuss here too many technical details. We only would like to stress that especially in carbides, the organization problems of a correct tool housekeeping policy are as important as the technical one.

Any plant management is certainly interested in covering the biggest variety of existing requirements with the smallest tool stock. To do so, the tools must be standardized, preferably in accordance with the A.S.A. tool standards. These tools are available on the market. (Small internal modifications of these standards, e.g., by grinding of standard chip breakers, may be performed in the tool or resharpening room.)

Tools for Small Lot Production

In producing small lots of parts, it is generally easier to select an

available cutting tool, which may not have the best shape and working angles, but which will do, than to order a more expensive and less available special tool. The advantages of such a policy are in:

1) delivery from stock of all standard tools (no delivery time);
2) lower capital investment in tool stocks;
3) much lower prices of standard tools than special tools;
4) more assurance that the requested tool is really what it is supposed to be, as checking of standard tools is more easily done.

The chief disadvantage of this method might consist in a slightly shorter tool life, if the admissible grinding of the selected standard tool is very different from the most desirable grinding.

To avoid any wrong use of tools we may have to apply two, or even three best-suited tools, rather than one single tool for sequence of cuts.

If the given machining operation cannot be well performed with an available standard tool, the process section of the manufacturing engineering department has to ask the tool design section for the development of a special tool. Such a tool should, as far as possible, be made by rework of a standard tool. If such a rework is not possible, the tool designer should try to apply a standard carbide tip and a tool shank of a standard cross section. Those measures tend to assure prompt delivery as well as low price.

Who Justifies Special Tools?

There are certain cases, where it will probably pay to make a special tool. This should be jointly decided by the process and tool design sections of the manufacturing engineering department.

Because of economic and technical reasons it is not always advisable to apply carbide tools for form cutting jobs. Carbides are serving very well here, provided that grinding is not too complicated, the profile to be cut does not present danger of breakage and, most important, we are easily able to apply a sufficiently high cutting speed. If these conditions may be held, carbide tools are used. (Work may be dry or with a water soluble emulsion.)

If the above conditions cannot be held, we should use a form tool of a cobalt high speed steel. It gives a much lower output, but also a much lower tool breakage. For best finish we have to interrupt the cut from time to time and to restore the protective film coating on the tool surface. (Cutting fluid will be polarized cutting oil, e.g. rape oil, sometimes applied by brush).

From Ideas To Standards

Individual tool rework or resharpening by machine shop people should not be allowed. This restriction does not mean that the "machine shop has nothing to say." On the contrary, it has, but this must be done in the correct way. Any initiative of the machine shop should be warmly welcomed by the manufacturing engineering services in the common cause of production improvement. Later, the achieved improvements have to be fixed on the paper as standard practice instructions, to make them available for anybody interested and facilitate their reproduction at a later date.

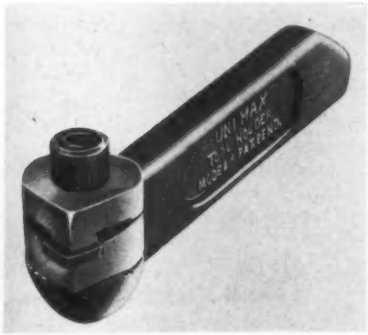
It is true that the manufacturing engineering or methods department should prepare the production conditions up to any smallest detail, but much as we wish it, this is not always possible, not only due to the human deficiency, but to the many factors involved.

Any reports from the machine shop would, therefore, not discredit the methods men, but give them valuable indications of how the arrangements work out in practice.

According to the tool circulation traffic, the manufacturing engineering department must send the tool requisitions to the tool and production control office, which orders the necessary tools either in the toolroom, or from tool dealers.

ONE TOOLHOLDER POSITIONS FOR ALL TURNING JOBS

A new idea in toolholders — the universal-positioning Throway carbide toolholder — has just been announced by Maxwell Industries, Inc. It combines the proven economy of carbide throwaway inserts with the added savings of universal positioning for all metal turning and shaping operations.



Ruggedly built with forged steel shank, anvil, and clamping cap assembly (with cap screw having nylon insert for rigid locking), the new toolholder makes it possible to position the carbide to any desired angle — right, straight, or left — or use for facing in either direction to or from center. Further economy results from the complete use of precision-ground positive rake carbide inserts, which can be indexed four times. The cap assembly also carries a replaceable adjustable carbide chipbreaker which may be indexed four times.

The one toolholder does away with the need for having several fixed angle holders in different sizes. It speeds the machine operator's work by eliminating the need to change holders from right hand to left hand or straight during a sequence of operations. And, when indexing the insert, it is not necessary to disturb the setup by taking the holder out of the machine; only the cap assembly is loosened, the carbide indexed, and cap retightened.

Any grade of carbide can be used with the Maxwell holder, and high speed square or round tool bits or boring bars can be used with a simple addition of a standard clamping cap.

Buying Tools To Be Reworked

There is also the possibility of buying tools and reworking them in the toolroom. The new tools should be inspected for accord to specifications on the drawing, good grinding, freedom of cracks, etc., and marked and painted to show carbide grade. Every tool has an individual control slip, for record and accounting purposes. The ready-to-use tools should be recorded in the tool index, such as the Kardex system, before placing in stock.

The worn tools return to the tool crib, to be exchanged for new ones. First they are checked by the tool inspector to separate all tools which did not end their service by regular gradual abrasive wear, but have been chipped or broken, indicate a built-up edge formation, or have cracks. Any irregularity is reported. Thus, it is possible to detect its cause and to avoid it in the future. The checked tools are sent to the toolroom for regrinding, from where they come back to the tool inspection and thence to the tool crib. Once a month the tool index is copied as a monthly tool stock list forwarded to all interested persons (tool and production control, manufacturing engineering department, machine shop, etc.) in order to assure the best use of the existing stocks and to avoid the formation of dead stocks, stored without use.

Tool Grinding

We do not need to stress the necessity of good tool grinding. Its objective should always be to furnish tools giving the best possible performance; tools ground as good as new. It does not matter whether we use a new or an old tool, its shape should always be exactly the same. If this is not possible, the tool should be scrapped.

Any new tool or reworked tool must be ground and marked as needed. It is very helpful to apply the color marking of the different carbide grades, as done for years in Europe.

After any grinding operations the shape of the tool (its cutting edge and profile, etc.) has necessarily to be inspected as to its conformity to the specifications. The same concerns a correct marking of the tool symbol and of carbide grade (painting of color on the shank end). A tool should have the index number visibly marked on its shank not exposed to damage by clamping screws. This identification mark should also be easily read during use and should, therefore, for a right hand turning tool be put on the left side of the shank. The carbide grade marking is of the highest importance, as it is difficult to suppose that anybody would remember and watch the different carbide grades, by so many manufacturers, available on the market.

Tool Inspection

There are two kinds of tool inspection, we are interested in:

(1) inspection of newly ground tools, to assure their uniform and high quality level;

(2) inspection of worn tools, coming back from the machine shop to be reground, in order to watch their wear and conclude the investigation of their practical application.

The last measure is of a preventive character. It does not allow any shop disease to grow up and will help in its very rapid cure. Any abnormally worn, any broken or chipped tool, any tool with built-up edge formation must not only be remarked by the tool inspector, but must become the interest of the machining engineer and thus result in correction of errors.

It is strongly stressed that the idea of inspecting worn tools, applied for instance in the huge Skoda Works in Czechoslovakia, is very helpful in assuring a proper use of cutting tools and high productivity of the machine shops. This does not mean investigation of all irregularities in the machine shop. Not at all. But it provides insight into any machine shop illness, which we have to rectify.

A good modern machine shop is producing chips. We should know

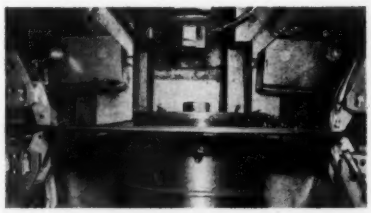
CHANGE OF CARBIDE INSERT TYPE CUT TOOL COSTS TO 1/5

Cost of cutting tools for machining 36" dia jet compressor discs was dropped from $1.72 to 31.4¢/disc recently by Curtiss-Wright Corp., Wright Aeronautical Division.

The $1.40 savings was made by a change in the type of carbide tooling in straddle facing operations. Kendex throw-away type triangular inserts with six cutting edges replaced diamond shape prismatic inserts with four cutting edges, which were reground six or eight times depending on the operation.

Special toolholders were designed by Wright tool engineers to enable use of Kennametal inserts. Four Kendex inserts are used simultaneously; two grade K21, Style TNG-432 for rough facing and two grade K4H, Style TNG-322 for semi-finishing. Compressor discs are made of SAE 9840 steel with hardness of 26-32 Rockwell C. Machining was done at 0.009" feed per revolution and 26 rpm. Depth of cut was 1/4" for rough facing and 0.030" for semi-finishing. Insert costs were computed as shown at left.

	Rough Facing		Semi-Finishing	
	Kendex	Prismatic	Kendex	Prismatic
Cost of two inserts	$3.10	$12.00	$1.34	$12.00
Regrinding ($1.10 ea)	0	13.20	0	17.60
Total cost	3.10	25.20	1.34	29.60
Number of discs machined	12	28	24	36
Cost per disc	0.258	0.90	0.056	0.82



whether the way we are producing them is identical to or different from our predictions.

Moreover we should check whether those methods applied are really the best ones .The best methods result only in a regular gradual wear, produced by abrasive friction. Only the inspection of worn tools will tell the answer.

The existence of a properly working tool inspection assures both:

(1) good and uniform tool quality of cutting tools for the production shop;

(2) a record of the actual level of machining practice applied in this machine shop. Also an increase in shop discipline and assurance that the tools will be correctly treated by people using them every day. (No damage in handling or in transport, no individual regrinding, no improper use).

Trouble Shooting

The technical description of carbide trouble shooting is presented in another report by the writer who would like to stress here rather the organization side of the problem, without entering too deeply into technical considerations.

The troubles may be detected not only by the tool inspector, checking the worn tools, but previously by the machine shop personnel. Anyhow the correct procedure of trouble shooting should preferably consist in their reporting to this inspector to centralize all information. He will report to the machining engineer or to the process analyst in the manufacturing engineering department.

The machine shop should have much to say and even make decisions. Thus, shop men should have a certain liberty in selection of carbide tool grades and in selection of the best adapted chip breakers from among tools with standard chip breakers available in the machine shop.

Thus, if the detailed process sheet calls for the use of a medium steel grade, a skilled operator has to be permitted to apply the hard steel grade, allowing for the same tool life a 40% increase of spindle speed. In this way the operator on incentive system would willingly offer a greater effort in order to work with a higher wear resistant and more brittle carbide grade which breaks out or chips more easily, because this effort would be paid by a higher rate. Production will be cheaper if tool breakage is not too high. Thus the interests of both the company and the workmen will be satisfied.

Choice of Chip Breakers

This also applies to correct use of chip breakers. The prescribed feed has to be applied because of the existing surface finish requirements. To operate at this speed when machinability of the material worked on is not uniform, with consequent variation in the performance of the regular chipbreaker, may call for switching to a variety of chipbreakers. Those chip breakers might be standardized to the extent to assure availability of chip breakers for any practical machining conditions.

In this way there is plenty of opportunity for a wise division of responsibility, leaving predictables to the manufacturing engineering services, while the items which are difficult to estimate, as the skill of the workman (necessary for more difficult work with a hard and brittle carbide grade), or as the machinability of the available steel lot (resulting in a variable chip formation), should be left to the shop.

Any trouble which seems to result from a defect in organization must be reported to the machining engineer or to the manufacturing engineering department, and result in an investigation.

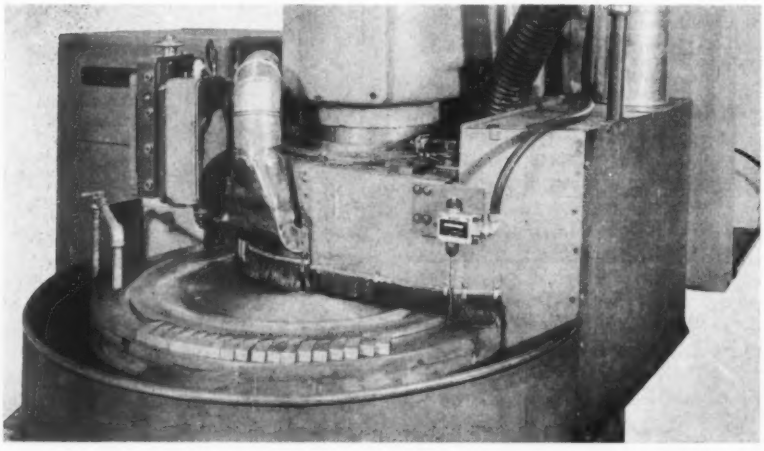
Efforts should go not only toward finish but to obtain an optimum in tool life, surface finish, and tool output. For this reason we should try to learn in all practical cases, the figures of tool life (pieces per grind) and of tool output (pieces per hour or per day, or machining time for data which might be picked up by the tool inspector, checking the worn tools).

end

VERTICAL ELECTROLYTIC GRINDER STEPS UP CARBIDE GRINDING

A new vertical-spindle electrolytic grinder is capable of extremely high production with minimum wheel wear in the grinding of brazed-type carbide tools.

For efficiency in loading and unloading the work, the table is equipped with wedge-shaped magnetic sections that are energized individually just before the workpieces go under the diamond wheel, and de-energized immediately after the pieces leave the wheel.



With this new grinder, built by Mattison Machine Works, surface finishes up to 6 micro-inches are obtainable while taking off up to 0.012″ of tungsten carbide in a single pass. Because there is no actual contact between the wheel and workpiece, the wheel wear is reduced as much as 90% over conventional methods.

The rotary table used has a speed range of 1.7 to 12 rph and the spindle motor is rated 25 hp, 1800 rpm. The 100 grit, 100 concentration, 16″ dia diamond wheel has a 4″ face, and a 1/16″ depth of diamond.

Special provisions are made for keeping the electrolyte away from the brushes that carry electric current to the grinding wheel, removing excess electrolyte vapors from the grinding wheel area, and condensing vapors for drainage back into the electrolyte storage.

MECHANIZED STAMPING OF BUICK STAINLESS TRIM

by Herbert Chase, M.E.

Use of both overhead and horizontal extractors for unloading dies yields economies and helps to avoid scratching, thereby lowering polishing costs. Belts and pusher supplement other handling aids.

BUICK MOTOR DIVISION'S SHEET METAL part production at Flint, Mich., long has included presses and polishing equipment to turn out a high volume of stainless steel moldings and panels for decorative trim. Such production is continuing and recently has been made more efficient by the addition of mechanized handling of parts such as appear in Figure 1.

Besides economies in handling, there is a secondary but important gain through reduction in scratching. Prepolished stock, chiefly 430 stainless 0.025" thick, is employed but some scratching is inevitable and has to be polished out after forming. Anything that helps to reduce scratching also tends to lower polishing costs, as less polishing is required.

Among the wider parts is the trim panel (bottom, Figure 1) the blanks for which, measuring about 12" x 18", are hand loaded with a rubber cup pickup into the die, Figure 2, in a 400-ton Warco press for initial forming. Extraction from this die is by an overhead Sahlin Iron Hand supported from the back of the press, as seen in Figure 3, saving a man for unloading there. Before picking up the stamping, the lower jaw of the gripper comes to rest on an extension back of the die.

When the jaw is moved in and closes, the Iron Hand retracts and releases the stamping into a chute down which the workpiece slides onto a short belt for delivery to the trim press, center in Figure 3. There, pickup is again by a hand cup used for loading as well as for unloading the trim die and for passing the stamping to the third press, left in Figure 3, where similar handling is done.

In this and four other dies in similar 125-ton Warco presses on this line, reforming, flanging, restriking and curling are done. Transfer is by hand or short belt conveyors. Some of the presses have two or three dies and require two operators but the line can complete about 325 pcs/hr.

In Figure 4, another overhead Iron Hand is shown after it has extracted a door molding from a 150-ton Warco press in whose die the molding, fed by hand from the far side, was formed. In this case, the Iron Hand has a permanent magnet that picks up the workpiece and swings it outward. Releases of the molding onto the short belt conveyor paralleling the rear side of the press is done automatically by a U-shape clip.

Without the Iron Hand, an extra man would be needed back of the press. Although men at the second press in the background of Figure 4 appear to be close to the Iron Hand, they are several feet beyond it; all motions of the hand being directly back of the nearer press, as well as back of the outer edge of the belt. In the second press, a hand loaded cam die wipes end flanges of the stamping back; and other presses in this line, some having dual dies, perform supplementary operations.

Many dies in this department do forming and other operations on long narrow moldings, such as that for a rear door, Figure 5. For some of these, a horizontal Sahlin Iron Hand has certain advantages over the press-supported overhead swinging type. The horizontal extractor is mounted on its own wheeled frame and so is easily moved from press

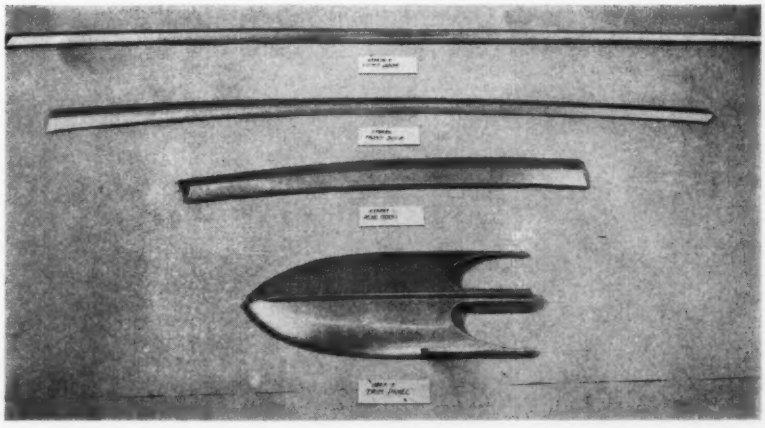


Fig. 1. Trim parts typical of those stamped from polished stainless steel in the Buick plant. Mechanical unloading of some parts from press dies has yielded considerable economies.

Fig. 2. In this setup, stainless blanks are loaded by hand but removed, after drawing, by an overhead, press-supported, swinging Sahlin Iron Hand, a part of which appears back of the die.

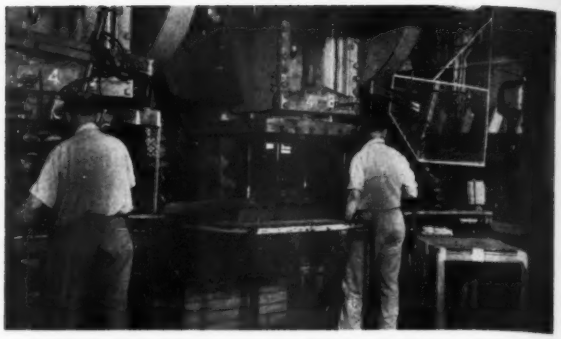


Fig. 3. Stainless stampings produced in the press, Figure 1 (shown here from the rear at the extreme right) are extracted by the Iron Hand back of the screen and then are advanced by belt to the first press on the line for supplementary operations.

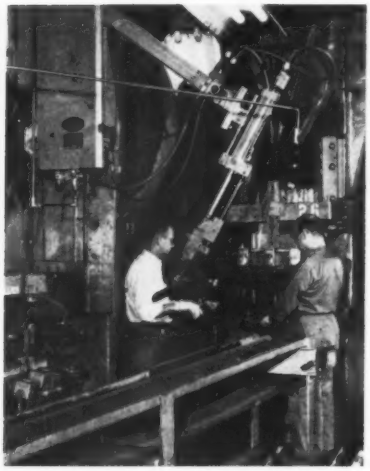


Fig. 4. Iron Hand equipped with a permanent magnet removing a door molding from the rear of the press at the left. This molding is dropped onto a belt for advance to the press in the background.

to press and is quickly adjusted to do various extraction jobs, making it unnecessary in each case to have an extra man for unloading.

Extractors of this type are timed, of course, to advance when the die is open, drop down to pick up the piece (using a permanent magnet in this case), elevate the stamping enough to clear the die, retract and drop the stamping where controls are set for this purpose. In the setup of Figure 5, the molding is released onto a chute down which it slides and is ready for the next operation, although discharge onto a belt conveyor could be employed if preferred.

Most stainless steel moldings produced in this department have a C-shaped section and are bowed to fit panels having a similar curved contour. In such cases, it is convenient to unload at the side of the press, sometimes with an extractor and sometimes by hand. In one special case, Figure 6, involving a straight molding, a simple device is employed.

Loading of the straight flat blank is done by hand parallel to the long dimension of the die and press. The press has openings at each end. In one of these openings there is a small air cylinder equipped with a rubber ended kicker plunger that remains retracted until the die opens and the shallow straight formed molding is lifted slightly. At this instant, air is admitted to the cylinder and the plunger moves forward, striking one end of the molding an axial blow and then retracting.

This blow drives the molding axially out of the opening at the other end of the press, where the molding drops into an inclined box placed to receive moldings as fast as they are ejected. As motion is along the molding's under surfaces that are hidden in assembly, no detrimental scratching occurs. Although the device works well in this special case, it has found only limited application, being suited only for long straight stampings.

Much manual unloading still is done in this department but most of it by operators who also do loading. Considerable economies result from mechanical unloading but they are chiefly where the unloading is done from the back of the press and where manual unloading would necessitate extra men.

end

Fig. 5. Horizontal type Iron Hand with permanent magnet pickup extracting a curved molding from the rear of a forming press. This extractor is mounted on its own wheeled frame and is easily shifted to other presses.

Fig. 6. Portion of a die for a long straight molding. An air pusher shown at left kicks the molding longitudinally so that it slides out of an opening (not shown) and into a container.

ELECTRONIC TRACER DRIVE REDUCES MACHINING TIME BY $\frac{3}{4}$

NEW ELECTRONIC TRACER DRIVES, designed for application to machine tools as feed drives on tracing operations, have been developed by Reliance Electric and Engineering Company.

To meet all types of complex tracing requirements, Reliance builds three types of V*S Tracer Drives. Each drive unit consists of a tracing template follower, Figure 1; an operator's station; a packaged, cabinet-mounted control unit; and controlled variable-speed d-c feed motors.

The tracing head, or follower, is rigidly mounted to the tool carriage so that it follows the contours of a tracing template. The control feed motors are mounted on the machine and coupled, usually through a gear reducer, to the tool feed screws. The motor control and regulating devices for the drive are housed in a single control cabinet which can be mounted on a common base with the machine, mounted on the machine itself, or in some out-of-the-way location near the machine. The operator's station, too, can be placed wherever it is readily accessible to the operator and allows him to observe the tool, work, template and follower.

The drives are used where high volume, repetitive parts are produced, since they cut down set-up time from piece to piece and also cut machining time as much as 75%. Depending upon the condition of the machine upon which the drive is mounted — such as amount of backlash, or condition of the lead screw—repetitive accuracy of up to 0.0015″ can be expected.

The drive is operated by changing the mechanical deflection of the template follower against the template into an electrical signal. The signal is then modified and amplified by the control unit and fed as a voltage signal to the d-c feed motors, which move the tool in the direction and at the correct distance to coincide perfectly with the template form.

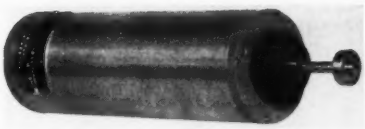


Fig. 1. The function of the tracing follower shown is to transmit the slightest change in the template contour to the tracer drive, which causes a corresponding movement of the cutting tool.

The tracer drives are so arranged as to permit the use of the machine tool manually, without using the tracer, merely by throwing a switch. They produce a constant feed rate, regardless of the contour of the template, to insure constant chip load and smooth surface finish. Speeds and feed rates can be changed any time, simply by adjusting a single speed rheostat. The drive system also provides under-deflection control, so that if the stylus loses contact with the template, the feed motion is stopped to prevent damage to the work, the tracing head or the template.

The tracer drives also have the ability to fully automatically trace either the inside or the outside of a closed loop, with no attention from the operator. An exclusive ball-and-socket stylus design provides for accidental deflection of the stylus up to 90° without incurring damage.

Types of tracer drives built by Reliance cover applications for single-axis, dual-axis, and full two-axis travel.

With a single axis drive, the feed rate, spindle speed and direction are constant, while the tracer has the ability to vary the tool position in two directions along one axis. With reversible feed the tracer operates in either direction with the same degree of accuracy. When the contour of the piece being machined is similar to those in Figure 2, the single axis drive is used.

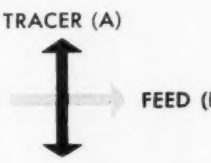
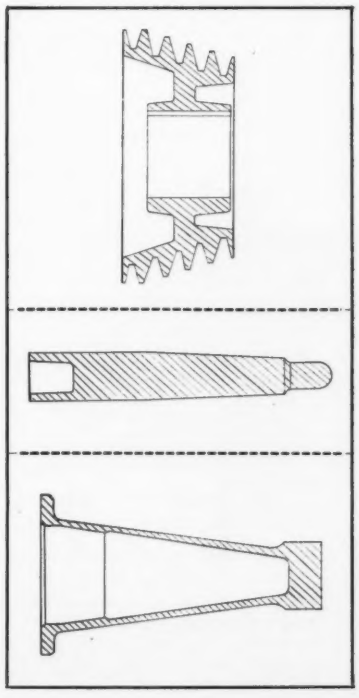
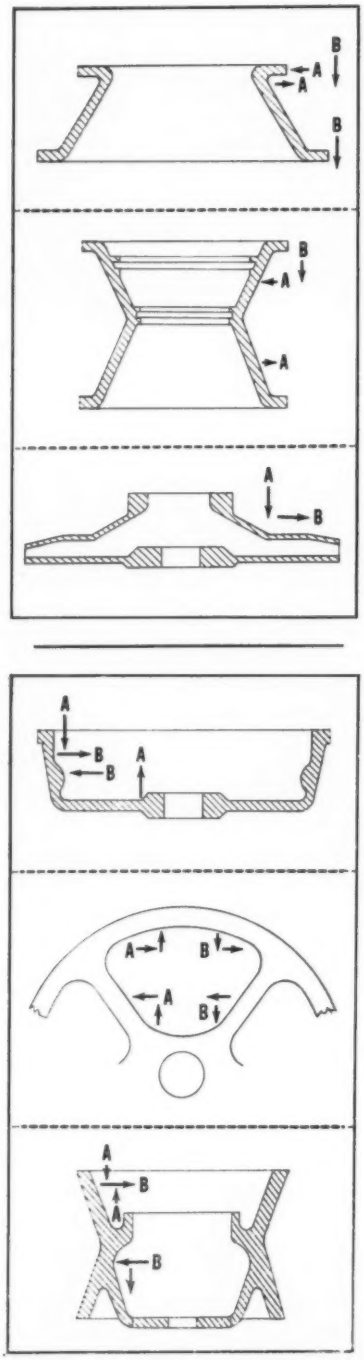


Fig. 2. The three workpieces shown are typical examples of parts turned on a single-axis tracer-drive-equipped machine. With this drive the tracer has the ability to vary the tool position in two directions along one axis.





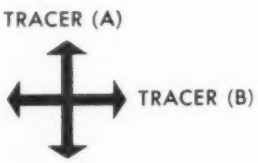


Fig. 4. Full two-axis drive has the ability to automatically follow the template along two axes in either direction as shown in the three machined parts.

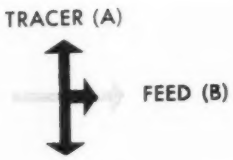


Fig. 3. The dual-axis tracer drive controls the cutting tool along two axes. The three parts shown demonstrate the result of the cutting tool moving on two axes.

The dual-axis drive controls the tool along two axes. The direction and speed of tool movement is automatically variable and reversible along one axis as in the single axis. Whichever axis gives the most flexibility is the one used. The speed of the feed along its axis, (B) Figure 3, is also automatically variable in one direction. Speed varies with the contour of the piece, to give optimum cutting speed throughout the operation. The tool movement along both axes is controlled from the same power source insuring coordinated machining along the two axes. As with the single axis tracer, the feed is manually reversible.

The full two-axis drive has the ability to automatically follow the template along two axes in either direction, Figure 4. Thus, no matter how complicated the contour of the piece, if it can be made into a template, the full two-axis tracer can make it. The coordinated action of the two-feed motors, plus the ability to run either forward or reverse, automatically gives the most in flexibility and accuracy.

All electrical and electronic circuits are contained in Sealpak units. These units represent the "building block" approach to electronic controls. In their construction, special purpose electronic circuits are printed on miniature circuit boards that are mounted on a multi-unit fixture with the proper resistors, capacitors, rectifiers, tube bases, and other components. This assembly is then fastened in position by crimping, Figure 5, left.

After either hand or dip soldering all connections, and electrically testing the completed assembly, it is locked in a two-part aluminum mold. A special hot plastic compound is poured into the mold, thus embedding the whole assembly.

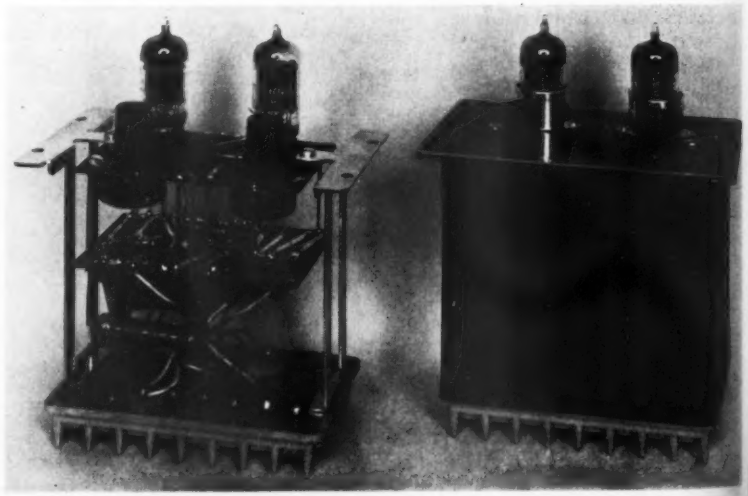
After baking the units for six hours in a low temperature oven, the mold halves are removed, leaving a complete block of permanently solidified, thermo-setting, non-reversible, high dielectric resin surrounding the assembled and tested circuit.

Front plate and tubes complete the Sealpak, Figure 5, right. Forty-seven different circuits are now made with Sealpak construction by Reliance, one of which is used on the tracer drive.

These units give the circuits complete protection against dirt, moisture and vibration. They also greatly facilitate trouble-shooting and circuit replacement, since only a voltmeter and screwdriver are needed to service them.

end

Fig. 5. Left—Assembly of Sealpak electrical and electronic circuits and components mounted on fixture ready for embedding in a plastic compound. Right—Sealpak unit embedded permanently in a high dielectric plastic compound complete with front plate and tubes installed.



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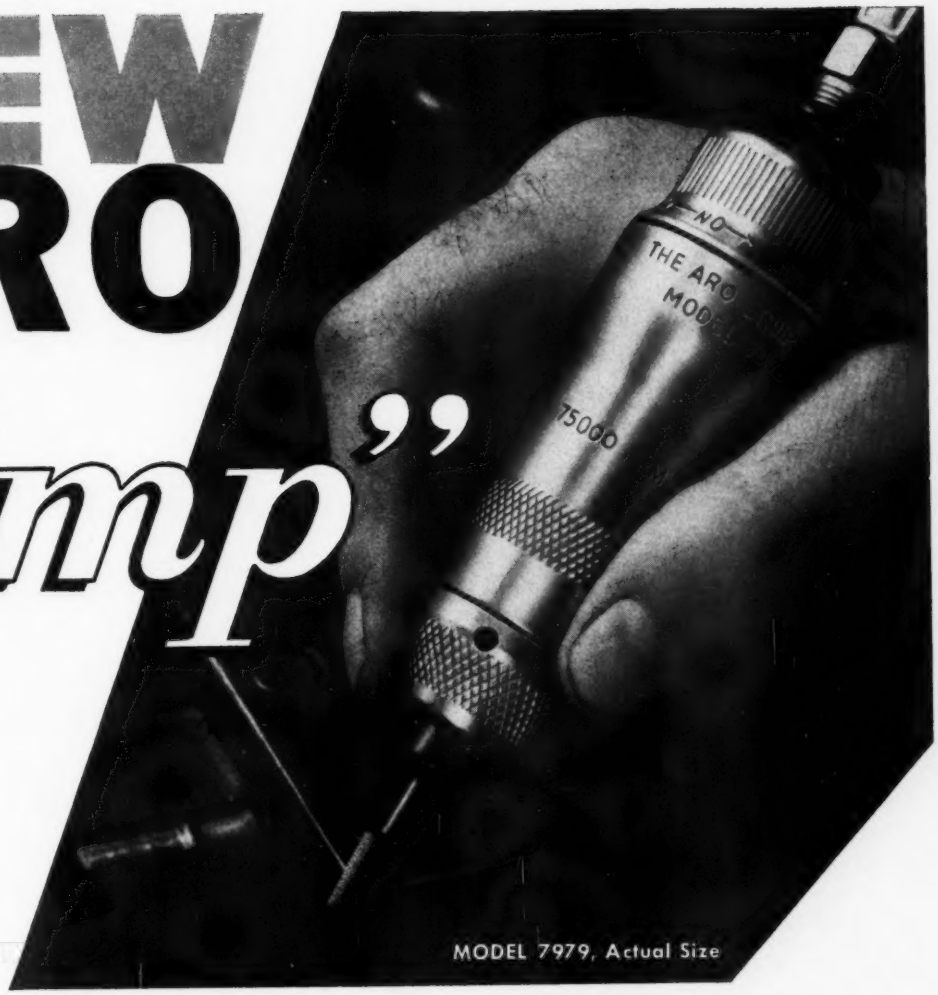

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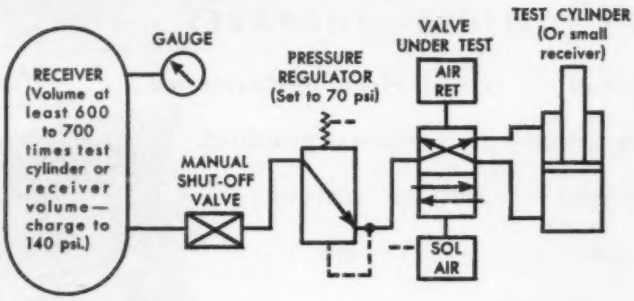
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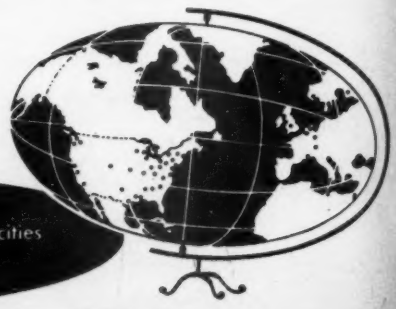

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NEW PRODUCTION DRILLING TECHNIQUES

by Harry Conn
Chief Engineer
SCULLY-JONES & COMPANY
Chicago 8, Illinois

ALMOST NOTHING HAS BEEN WRITTEN on the effect of drill bushings on tool life, rigidity, tool changing time, hole position, torsional strength and spindle wear due to misalignment. This article is designed to arouse interest in this subject.

The most important problems have been short tool life per grind, excessive time for changing tools, accuracy in hole location, drill breakage and size.

Some of the conditions that have caused the problems have been low torsional strength of long twist drills, chatter, excessive bending due to too much feed, lack of rigidity at chisel point when the drill is starting to cut. The bushings hinder removal when the bushing plate is carried by guide rods in the head of the machine. The margins of the drill are often undersize due to a rubbing action against the wall of the hardened bushing, which is also due to drill runout, spindle misalignment. The errors in drill point grinding can cause an excessive amount of side thrust which will wear the margin of the drill. Most drill margin wear is a result of the corner of the drill becoming dull and the margin then begins to wear. Marginal wear usually takes place during the last 25% of effective drill life.

Almost all cutting tools and holders, when being designed, usually have strength and rigidity as the prime factors to be considered. It is certain that all tool and machine designers try to reduce overhang so as to increase rigidity and strength. This is true with almost all cutting tools other than twist drills. The only exception to this in the twist drill family is the screw machine series.

A two fluted twist drill at its very best operating condition has the design characteristics of a torsion spring but with the addition of the cutting edges. It then follows that the shorter the drill the stiffer it will be, hence the more it will resist chattering which is the greatest hindrance to long tool life.

Figure 1 shows the results of shortening the projection of a 0.257" drill in S-816 high temperature al-

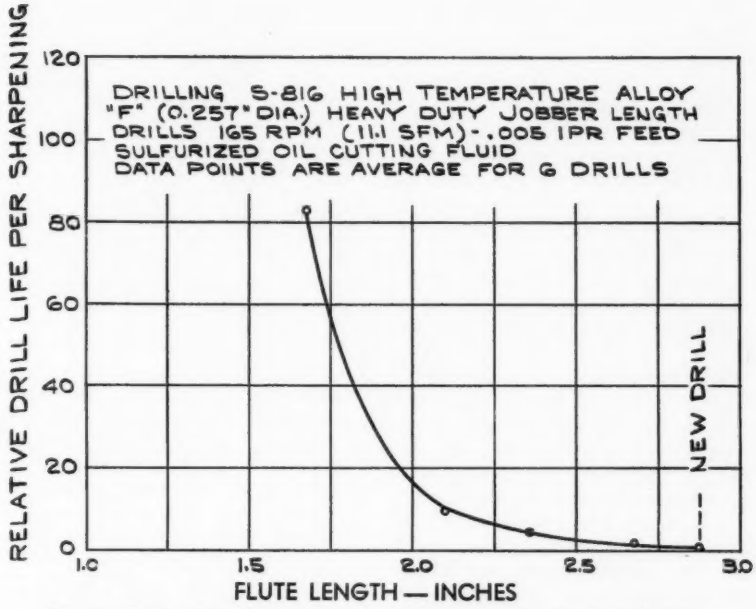

Fig. 1. This series of tests, conducted by Carl Oxford, Director of Research, National Twist Drill and Tool Company, shows that as the drill projection was shortened (thus reducing torsional windup) from 2-7/8" to 1-11/16" the relative drill life per sharpening was increased 80 times.

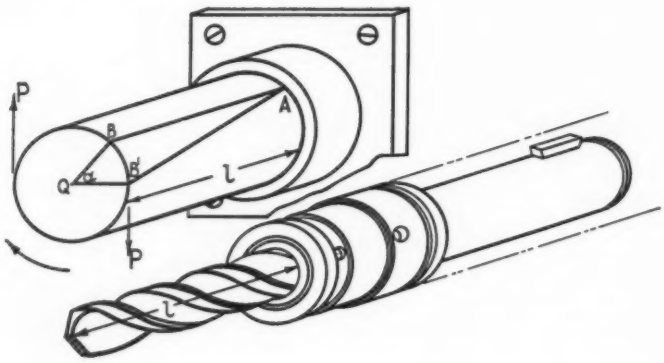

Fig. 2. A twist drill behaves similarly to a steel bar when torque is applied. The angle of twist will be greatest at the far end, and at any other point the angle of twist will be proportional to the distance from the end. Thus it is readily seen that the less projection a drill has from its chuck the less the angle of twist will be during the cutting action.

loy. In shortening the drill projection from the chuck, the torsional vibration was drastically reduced thereby increasing rigidity and the effect was a phenomenal improvement in pieces drilled per grind. This is not an isolated case nor the most unusual or eye-opening example. Using this same principle, but with different circumstances, the holes drilled per sharpening was increased 300 times. These jobs were drilled with no bushings to guide the drill.

The steel bar diagrammed in Figure 2 will have a torsional twist when torque P is applied.

Figure 4 shows the modern trend in tooling a high production machine. It compares the old and the new way, and shows the inside of the quick-change, pre-set tool of Figure 3. The drill is gripped on the margins for locating and driving and a back-up adjustment screw for depth is also used as a positive drive.

A twist drill is subject to three main forces: an axial thrust used for feeding; a radial force called torque for turning the drill; and side thrust. Drill bushings are used in production machines for overcoming a side thrust that can be caused by drill grinding irregularities, rough surface and excessive spindle runout. Small drills (5/16" and smaller) have very little, if any, side thrust. When the two cutting edges of a drill cut unevenly, or with what would be called a tangential force in single point cutting, the third force is added which is called side thrust.

Some engineers seem to think that the elimination of bushings and bushing plates will necessitate much larger spindle bearings. The main wear on spindle bearings is caused by a mis-alignment between the spindle and the bushing. Therefore, when mis-alignment of over 0.002" is present, this condition is causing not only a wear on the bushing, which is easily replaced, but spindle bearing wear and spindle deflection. The main design consideration of drilling spindle bearings is axial thrust, and stub drilling will not alter that requirement. The side thrust is important only

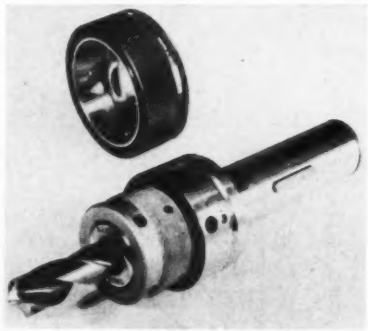

Fig. 3. A Scully-Jones "Stub-A-Long" drill collet check and "Quick-Ball-Lock" collar for multiple spindle drilling heads.

while the drill point is entering the workpiece because after the margin of the drill has entered the material, the hole becomes an outboard bearing support. A bushing is helpful in reducing side thrust and increasing rigidity when the drill is starting to cut.

If the ratio of drill projection to diameter is low enough, bushings are not needed in many instances. A ½" drill projecting 2" is a very rigid tool.

There is invariably a mis-alignment of the drill with the drill bushing which can be due to any or a combination of these factors. The lack of straightness of the drill or eccentricity, tool holding eccentricities, eccentricity between hole in spindle and spindle bearings, expansion of drill head because of temperature rise over the temperature at which the drill head was bored, clearance in spindle for tool holding insertion, banging and bearing of spindles to remove drills from spindles causing spindle runout, are just some of the causes for mis-alignment of the drill with the drill bushing.

A very high percentage of holes that are drilled in high production setups fall into one of four categories that do not require close or high tolerance dimensional hole spacing; they are:

1. A hole that will be tapped.
2. A clearance hole for a bolt that will be screwed into the tapped hole. The clearance hole may be from 1/64 to 1/16 larger than the body diameter of the fastening member.
3. An oil hole.
4. A hole that will be reamed in a subsequent operation.

The tool holders and drills of Fig-

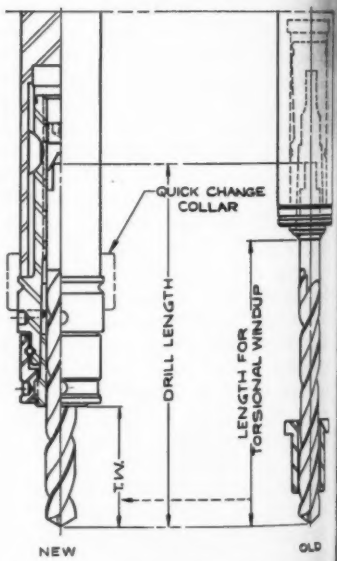

Fig. 4. The latest methods of gripping and driving a twist drill near the work favor a much shorter length subject to torsional windup (T.W.).

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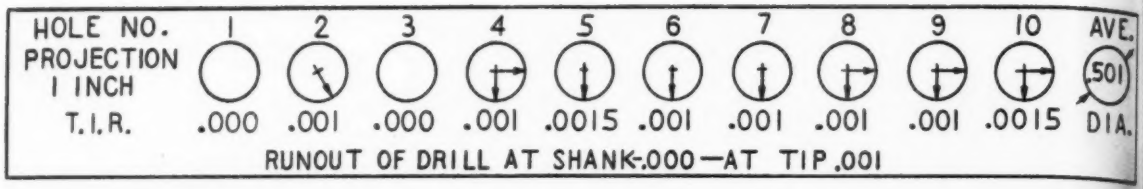
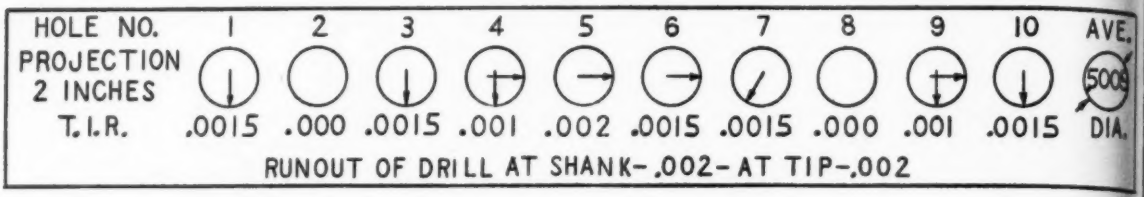
ROTOR AIR TOOLS: Assembly Tools • Drills • Small Wheel Grinders • Straight Grinders • Vertical Grinders • Scalers Chippers • Rammers • Special Tools • Air Motors
ROTOR HIGH-CYCLE ELECTRIC TOOLS: Grinders • Polishers • Sanders

CIRCLE INFORM-A-GRAM KEY NO. 57


HOLE NO. 1 2 3 4 5 6 7 8 9 10 AVE.
PROJECTION 1 INCH
T.I.R. .000 .001 .000 .001 .0015 .001 .001 .001 .001 .0015 .501 DIA.
RUNOUT OF DRILL AT SHANK-.000—AT TIP .001



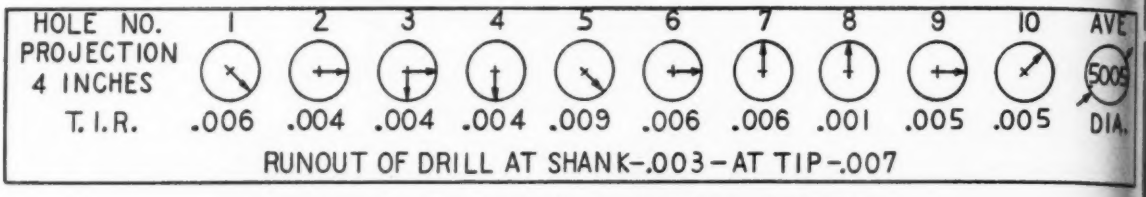

HOLE NO. 1 2 3 4 5 6 7 8 9 10 AVE.
PROJECTION 4 INCHES
T.I.R. .006 .004 .004 .004 .009 .006 .006 .001 .005 .005 .5005 DIA.
RUNOUT OF DRILL AT SHANK-.003-AT TIP-.007

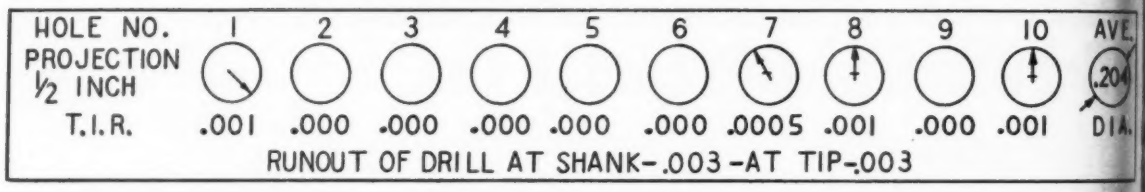
Fig. 5. A series of runout check (with final averages) on 0.500" dia test holes drilled without use of guide bushings. Conventional chisel point grinds. Speed: 600 rpm; Feed: 4.8" per min.; Feed per rev: 0.008"; Hole depth: 0.500". Material: CRS, Finished surface.

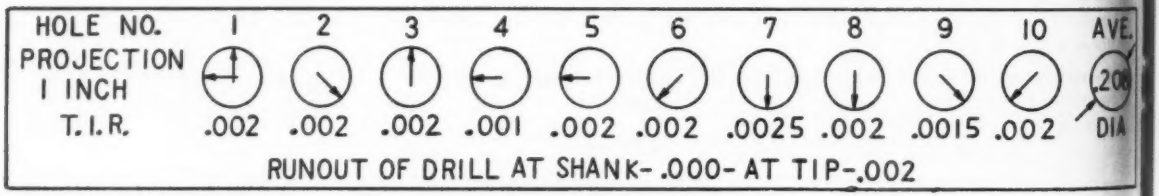
ure 4 show the old and the new way of production drilling and the methods of holding the drills. The advantages are very apparent.

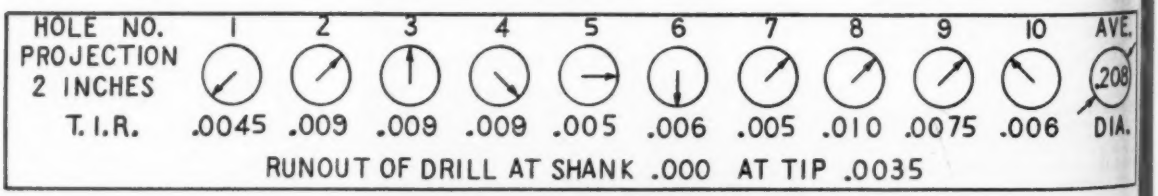
Figures 5 and 6 show the results of drilling tests that did not use bushings to guide the drill. No attempt was made to make the drills run true, the collets holding the drills were unground. Unground collets were used because an attempt to simulate the actual production conditions was desirable. Many other similar tests have been made to determine hole positions at various projections on varied surface conditions.

The figures under each hole show how much the hole moved in thousandths of an inch with relation to the true axis of the spindle. The ar-

Fig. 6. A series of runout checks (with final averages) on 0.2031" dia test holes drilled without use of guide bushings. Conventional chisel point grinds. Speed: 1100 rpm; Feed: 4.8" per min; Feed per rev: 0.0044"; Hole depth: 0.500"; Material: CRS, Finished surface.


HOLE NO. 1 2 3 4 5 6 7 8 9 10 AVE.
PROJECTION ½ INCH
T.I.R. .001 .000 .000 .000 .000 .000 .0005 .001 .000 .001 .204 DIA.
RUNOUT OF DRILL AT SHANK-.003-AT TIP-.003


HOLE NO. 1 2 3 4 5 6 7 8 9 10 AVE.
PROJECTION 1 INCH
T.I.R. .002 .002 .002 .001 .002 .002 .0025 .002 .0015 .002 .206 DIA
RUNOUT OF DRILL AT SHANK-.000-AT TIP-.002


HOLE NO. 1 2 3 4 5 6 7 8 9 10 AVE.
PROJECTION 2 INCHES
T.I.R. .0045 .009 .009 .009 .005 .006 .005 .010 .0075 .006 .208 DIA.
RUNOUT OF DRILL AT SHANK .000 AT TIP .0035

New! FREE CUSHIONS*

MEAD
DURA-LIFE
CYLINDERS

Compare these prices!

1½" Bore — $29.95	**3¼" Bore — $46.40**
2½" Bore — $37.80	**4" Bore — $53.35**

Prices slightly higher West of Rockies.

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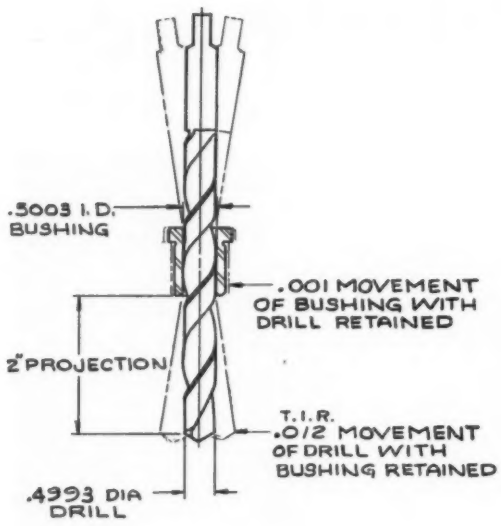

.5003 I.D. BUSHING
.001 MOVEMENT OF BUSHING WITH DRILL RETAINED
2" PROJECTION
T.I.R. .012 MOVEMENT OF DRILL WITH BUSHING RETAINED
.4993 DIA DRILL

Fig. 7. The variables that can detract from accuracy when using a standard drill and bushing. Drill dia: ½" +0.0000, −0.0015. Back taper: 0.0005"/in. Bushing ID: ½" +0.0001, +0.0005.

row indicates the direction the holes moved. The positional figures in each hole, for each length of projection of the drills and average sizes should be of real interest to machine tool designers, tool designers and process engineers.

Figure 7 depicts the conditions that can occur when a standard drill is used in a standard bushing. The back taper on the drill, spindle run-out, the drill tolerance, the short bearing wrap-around area of the drill margins in the bushing, all limit the bushing from guiding the drill (and supporting it for side thrust or hole locations) to the extent desired. It is conceded that the bushing is needed for rigidity when drilling very hard materials.

The new method of holding the drills in a stubbed-up manner eliminates the need for a bushing plate, thereby enabling the operator to quick-change the tools. The cost of changing a drill in high production transfer machines ranges from 6 to 1000 times the perishable or tool depreciation cost per insertion. When the quick-change collar, Figure 3, is used for tool changes and the drill is pre-set the tool changing time or cost is reduced at least 80%.

When drilling steel there are two kinds of action which remove the metal: the metal at the very center is extruded by the axial force on the chisel point. Shaw's experiments proved that the lips of the drill remove the metal by a cutting action which starts at about the OD of the web thickness. Therefore, when a drill starts to cut, the chisel point has a tendency to "stagger" around due to radial and side thrust deflection. A drill at its point seems to have the design characteristic of a cantilever beam, or at its best condition is a cantilever beam with an end couple. Then when the drill margins enter the hole it can be described as one end free, other end fixed with axial and radial forces applied, provided the hole is slightly larger than the drill.

When using the standard equation for computing deflection of bars or beams when one end is fixed, the rigidity is a function of the projection to the 3rd power, Figure 2. This graph shows how deflection is greatly increased as the projection is increased. A twist drill's rigidity will follow a comparable pattern. This line of reasoning simply leads one to the conclusion that the shorter the drill projects from its holder the less it should deflect and twist, thereby increasing the values that resist the chatter which reduces tool life.

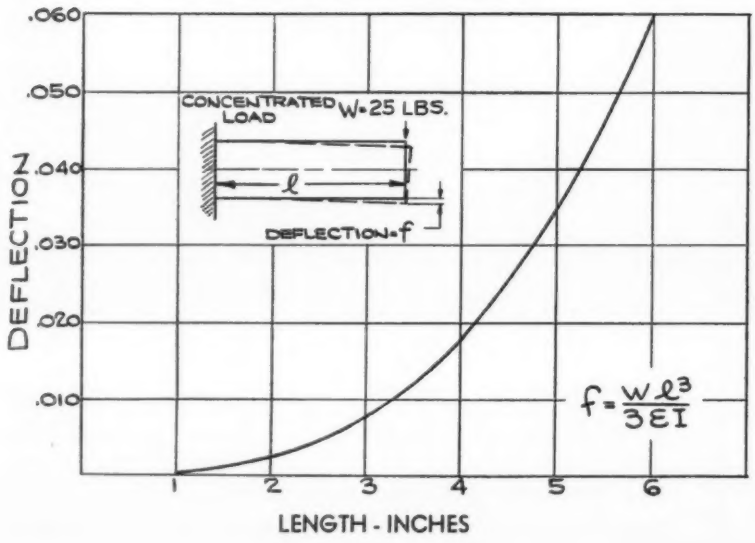
The understanding of these principles should result in influencing the design of drilling spindles to the end that they should become shorter in projection and that the heads should approach the work much closer than is now being done. The return stroke should allow ample clearance for the removal of the tools and holders, thereby eliminating banging and beating. Drill head spindle locations will be made to tighter hole to hole dimensioning instead of leaving the precision to be built into the bushing plates as was the former practice. If the drill head temperature rise is known, the heads may be bored short, allowing for expansion.

In some instances, it may be necessary to use double margin drills when employing this stub drilling concept.

These principles as applied to stub drilling have been used very recently by Chevrolet, Chrysler, Detroit Transmission, Pontiac, Cadillac, and Westinghouse in transfer machines. It is not intended to disparage the using of bushings to guide the drills in jigs that are moved around by hand or even the adjustable multiple spindle setups.

In summation, the potential savings of stub drilling, without bushing plates or their maintenance, should be attractive to cost conscious engineers in obtaining more pieces per grind, sharply reduced tool changing cost and more production time per hour.

Fig. 8. Deflection of bars of 3/8" dia.



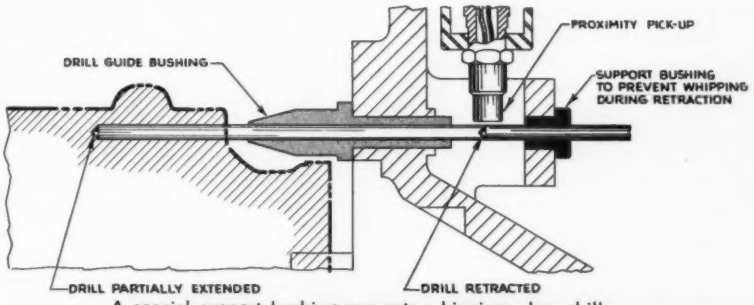
PROXIMITY SWITCHES PROTECT LONG SLENDER DEEP HOLE DRILLS

ALTHOUGH ANY SMALL DRILL is vulnerable to breakage, one that has a length-to-diameter ratio of 50:1 is especially ripe for production troubles. An automotive-parts manufacturer, however, has been able to drill ¼" holes, 7¾" deep economically, with an automatic machine developed and built by Buhr Machine Tool Company.

For this operation, it was more important to keep tool costs per piece low than to have a low machine cost. The machine, therefore, was designed to minimize both the breakage of the twist drills selected for the job and the damage that could result from broken drills.

The workpiece is an automobile steering gear housing. Because the ¼" hole diameter is not critical (it is an oil passage), tool breakage was reduced by drilling it in five passes. Each pass adds to the depth of the hole but with a slightly smaller diameter. The last pass is made with a ¼" drill and completes the hole to depth. By gradually decreasing the drill diameters in this way, rubbing is reduced and good clearing of the chips is assured.

Design of the machine is rather simple: Five hydraulic-feed units are arranged around an automatic 6-position index table. Each feed unit carries two high-speed spindles for drills of the same size. Two workpieces are hydraulically clamped in each of the six holding-fixture positions.



A special support bushing prevents whipping when drills are retracted. The proximity pick-up is over the point of the drill when it is fully withdrawn and continuously checks drill condition.

Automatic cycles for each of the feed units include rapid forward, feed, positive stop, and automatic reverse. Times for each of these steps are different for the different heads but each cycle totals 27 sec. Accurate index table positions are assured through use of a shot pin.

The long, slender drills are supported and guided by bushings during the drilling stroke. To prevent whipping and breaking during retraction and part indexing, a second support bushing is located at the back of the bushing plate.

Since it would be time-consuming and costly to probe holes for broken drills after each drilling step, the machine was designed to continuously check drill condition. A proximity switch pick-up is located at a set distance from the drill and between the two bushings. When the drill is fully retracted, its point comes under the midpoint of this pick-up.

The metal of the drill provides a path for flux lines which initiates an electrical circuit. If the drill breaks, the circuit is broken and this amplified signal shuts down the machine. A red lamp glows to indicate which drill is broken.

There is no chance for machine or workpiece damage because when a drill breaks, a control relay in the "index" and "advance units" circuits opens to stop the machine cycle. Proximity control units are reset simply by replacing the broken drill. When the proximity control circuit is again closed, the control relay automatically closes and the machine is again ready for operation.

A selector switch is located at each of the hydraulic feed units so the proximity switches for that unit can be by-passed during set-up and maintenance operations. end

IMPROVED BROACH CUTS COSTS FOR AUTOMAKER

An improved surface broaching tool, used to remove 1/16" - 3/32" of cast iron stock from two mounting surfaces of automotive oil pump brackets, has saved an automobile plant $9500 in 116 eight-hr shifts.

Kennametal, Inc. redesigned the original tool, using Kendex round button inserts to replace most of the rectangular carbide inserts or blades in each of two broach strips. This eliminated the rapid corner wear and excessive breakage that had made tool reconditioning necessary after every third eight-hr shift. Thirty-eight reconditionings, at an average cost of $250 each, were thus eliminated.

The new broach has a set of ⅝" dia x ⅛" thick Kendex Grade K6 carbide inserts to remove most of the stock, and three square Kendex inserts for finishing cuts to clean up remaining stock. All inserts are supported by shims that insure accurate indexing. Positive seating is provided by an additional back-up insert.

HUMP FURNACE CUTS COST OF TREATING STAINLESS STEEL PARTS

Stainless steel dies weighing up to 400 lbs are bright hardened with uniform hardness and a minimum of distortion by a hump-type, 20″ mesh-belt electric furnace at Specialty Steel Treating, Inc.

Designed and built by General Electric's Industrial Heating Department, the furnace is used also for continuous bright brazing of stainless steel assemblies without flux, and for bright annealing and hardening of metal parts such as aircraft components, which must be finished to very close tolerances. The hump-type construction saves atmosphere gas and provides bright, oxide-free results.

The furnace has reduced the cost of heat-treating stainless steel at Specialty Steel Treating, by eliminating the rejects. Additional machining of dies to correct distortion caused by hardening — a costly and difficult process — is not necessary due to the close tolerances obtained with the equipment.

Two-zone control in the hump-type furnace helps achieve maximum production by maintaining a controlled temperature at the exit end. Cold materials entering the first zone do not affect the controlled temperature in the second zone.

The 20″ wide mesh-belt handles approximately 720 parts/hr, totaling about 200 lbs. Eight parts, six abreast, move through the hump-type chamber each minute.

New accomplishment in automation with new Logamatic 410

automated turret lathe with air-hydraulic cross slides

Only the Logan Logamatic 410 offers so many features in its price range! Swing over bed, 14⅝″. Swing over cross slide, 6⅞″. Spindle bearings: (4) ABEC Class 7. Speed range, 25 to 2,000 rpm. Two-speed, 3—1½ hp. Dinabrake motor and controls are standard equipment.

$8,800.00*

*F.O.B. factory, including motor and controls complete, less 8″ power chuck accessory. Price subject to change.

- Electric power-turret feed
- Automatic cycling
- Adjustable rapid travel
- Variable-rate turret feed
- Variable-rate cross slide feed
- Variable-speed drive
- Pushbutton control
- Available as bar-feed machine
- L-0 spindle nose

LOGAN ENGINEERING CO. Dept. M-259, 4901 Lawrence Avenue, Chicago 30, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 62

BAND SAWING SPEEDS UP DESTRUCTIVE TESTING OF CASTINGS

Engine blocks and similar parts with complex cores can be accurately inspected only after slicing them apart. This operation is time consuming and expensive because much of the cutting is through irregular cross-sections containing hard spots and occluded sand. The narrow kerf of the band machine permits the exceptionally fast and efficient parting needed. Therefore, the desired standard DoAll features were combined in two new machines built specially for rapid sectioning of iron, steel, and aluminum castings.

The smaller machine has a 25″ work height and a 48″ stroke table that travels on Thomson linear ball bushings. The larger machine has a 36″ work height and a 48″ stroke table using automatically lubricated V-ways.

These machines have provisions for changing the saw band whenever necessary without disturbing the setup. Smooth, positive hydraulic table feed provides infinitely variable rates from 1 ipm to 8 fpm.

These DoAll band machines also feature variable speed transmissions, job selectors, and a wide range of saw guides.

Quality made them
the choice of
Production

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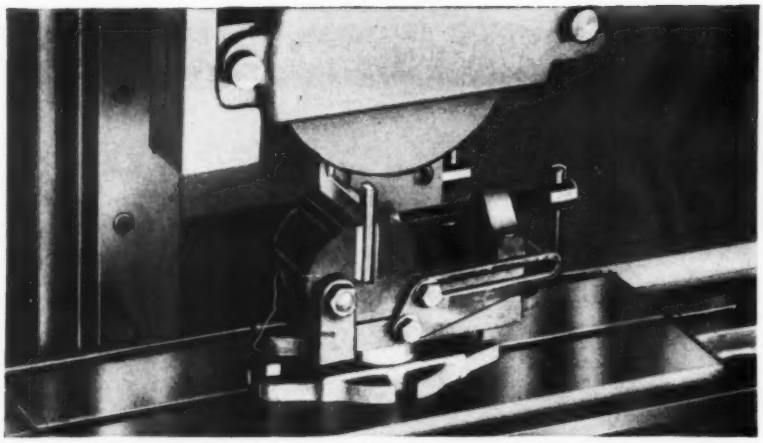


This is not an ordinary surface grinder at work...

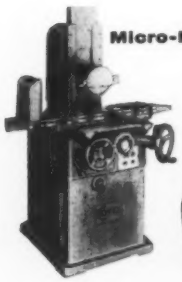
It's a Covel No. 10—built to do MICRO-PRECISION work on accurate snap gages like this. And it also does a top-notch grinding job on other tool room work such as form tools, jigs and dies—day after day and year after year to save you money. Covel pioneered with *hard chrome table ways* that keep this 6" x 18" machine in *top position* in the tool room grinder line-up far longer than grinders with ordinary ways. Covel-developed smooth *timing belt table drive*, hardened and ground lead screws and rigid vertical slide are among other outstanding features that add up to long-lived Covel MICRO-PRECISION performance.

First with hard chrome table ways...

A special plating process developed by Covel applies a hard chrome surface to hand-scraped Vee and flat table ways—insuring long-lived accuracy. Many Covel chrome plated ways have been in service for ten years and more without noticeable wear and without a sign of flaking.

Ruggedly built... hand or power feed models available

The No. 10, like all Covel Precision Grinders, depends on a heavy, well-ribbed and proportioned base and wheel head standard as a foundation for built-in MICRO-PRECISION. Both hand and power feed models have all hand wheels, including elevating hand wheel, conveniently located *below* table level.



Micro-Precision a Covel Tradition-Since 1874

Send today for your copy of "The Covel Precision Story" and complete data on the Covel Surface Grinder that meets your needs — seven sizes from 6" x 12" to 16" x 36". Ask for Bulletin T-29

COVEL PRECISION GRINDERS

BENTON HARBOR, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 64

Latrobe Steel Co. makes known the advancement of **W. G. Dahl** from general sales manager to vice president of sales, and the return of **Howard M. Givens,** former vice president of sales, Miami, Fla., as southern regional sales manager.

George C. Hall succeeds **Harry A. Pierce** as manager of industrial distributor sales for Rollway Bearing Co., Inc. Pierce continues as a consultant to the sales department.

Thomas D. Burley has been named to the newly-created post of manager of high temperature steel sales for The Carpenter Steel Co.

Appointment of **James S. Lefler** as the Chicago area engineering representative of Telecontrol Division, Hancock Industries, Inc., was announced recently. He covers Illinois, Indiana, and southern Wisconsin, and has offices in South Bend, Ind.

W. Scott Bliss is the new vice president-marketing at Vulcan-Kidd Steel Division, H. K. Porter Co., Inc. He is responsible for over-all general marketing and sales policies of the products of this division.

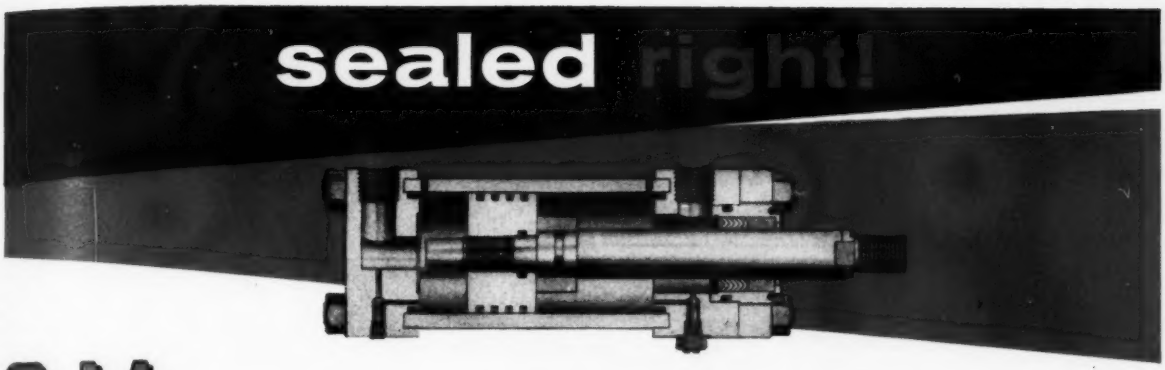
Industrial Tectonics, Inc., has named **Donald C. Kane** sales manager for the Western Division plant. He handles both ball and bearing sales for all western states.

Announcement of the advancement of **LeRoy Van Valkenburg** to sales manager has been made known by the Instrument Division of Davidson Mfg. Co. He is now supervising the expanded marketing program of the company's line of electrical and optical instruments.

Moving up from assistant sales manager to sales manager for the machine and tool division of Michigan Tool Co. is **Irvin R. Spangler.** He takes over for **Paul F. Zerkle,** who is now a member of the executive staff working on special assignments.

Promotion of **John W. Touhy** to assistant sales manager of Wilton Tool Mfg. Co., Inc., has been made known.

Cole D. Bacon moves up to western regional sales manager for Brush Instruments, Division of Clevite Corp. He directs sales and service operations and supervises operations of Brush district offices in Seattle and San Francisco.



O-M Heavy-Duty Series TH Hydraulic (Oil) Cylinders

IF you are experiencing difficulty with leakage through the seals and packings of the cylinders you have been using, the O-M "TH" Series Heavy Duty Hydraulic cylinders may be the answer to your problem. Since their introduction in 1955 these cylinders have established an enviable reputation for efficient and trouble-free service.

The O-M Series TH Cylinders are Designed Right to Seal Right. Prior to the design of these cylinders, many tests were made and field experiences were surveyed to find the most efficient way to eliminate the old "leakage problem".

Homogeneous "O" rings, with their elastic characteristics, cannot be excelled as static seals when backed-up with plasticized leather non-extrusion rings and installed in a properly designed cavity.

Ring-type piston packings are excellent for long-life and trouble-free performance when a small amount of piston by-pass is permissible. When by-pass is not allowable, "Vee-type" packings similar to those used as standard in the rod gland provide optimum sealing. The "Vee-type" packing is self adjusting and provides multiple lip sealing with excellent pressure sensitivity and long life.

The homogeneous "lip-type" rod wiper or the metallic scraper (your choice) is located well forward so as to prevent dirt from accumulating and scoring the piston rod and damaging the bearing and packing.

O-M Series TH Cylinders are "Designed Right" and "Sealed Right". Available in 1½" to 8" bores with complete selection of mountings. Mail coupon TODAY for Bulletin No. 105 showing description drawings of cylinders mountings and capacity chart.

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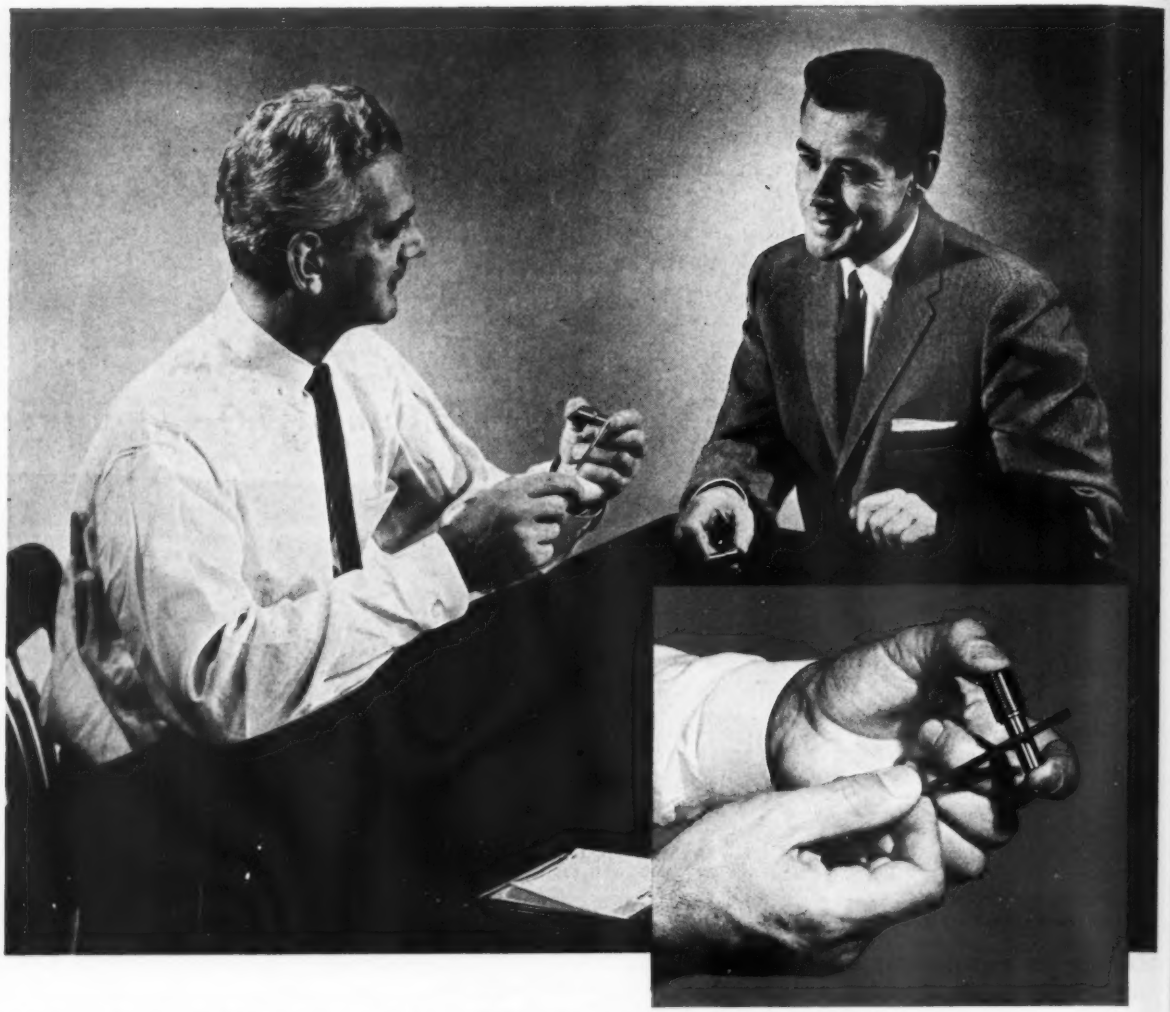

SLASHES GAGE COSTS UP TO 80 PERCENT

IF your steel thread plug gages had a hardness of 67C or 69C—their wear life would increase from 2 to 5 times and your inspection costs would drop an equivalent amount.

It's no longer a question of "IF". The new Sheffield Flint-Hard Nitrigage* has IT. And at STANDARD STEEL PRICES.

Here's the proof! Use the old reliable file test. First draw a new file over the shank of one of your best tool steel gages. Feel it bite? Then try the same test with a FLINT-HARD NITRIGAGE and feel it smoothly glide over the surface. The difference means COST SAVINGS.

ACT NOW and start Cutting Costs! Order a sample now. Put it to the file test and then on the job. The longer wear life reduces your outlay of funds. Write to the Sheffield Corporation, Dayton 1, Ohio, U.S.A., Dept. 20.

*Available now in standard pitches—¼" to 1½"

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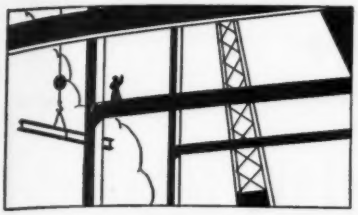
CIRCLE INFORM-A-GRAM KEY NO. 66

GROWING PAINS



A new $2,500,000 plant in Danbury, Conn., with 125,000 sq ft of floor space for the manufacture of instrument precision ball bearings, was opened recently by **The Barden Corp.**

The Dearborn Mfg. Co. of Detroit has announced the purchase of two acres of land for a quarter-million-dollar plant and office building that will more than double the space of the present plant.

The opening of a 11,000 sq ft structure has completed the second phase of **United States Drill Head Co.'s** three-quarter-million dollar building program. The building will house the Standard Pattern Division. Ground will be broken soon for a third unit, a 45,000 sq ft building, for the Machine Tool Division.

The newest source of stainless steel sheet and strip in the country is now in full operation. The $17-million Stainless and Strip Division plant of **Jones & Laughlin Steel Corp.** has an annual capacity of 36,000 tons of flat rolled stainless steel.

Expansion in its vacuum melting operations for the production of super alloy steels has been made known by **Latrobe Steel Co.** A new consumable electrode vacuum melting furnace and allied equipment will be housed in a new structure expected to be in operation soon.

Rolled Alloys, Inc. has purchased 43,000 sq ft of floor space of the former Packard properties in Detroit. This new plant will be able to handle larger stocks of heat and corrosion resistant alloys.

A 50% addition to their manufacturing facilities has been completed by **Ulbrich Stainless Steels.** Now they are able to have a stainless steel inventory of 2,000,000 lbs.

Ground has been broken by **Turco Products, Inc.** for a 66,000 sq ft million-dollar national headquarters near Los Angeles. The new facility will be composed of an administration building, a research center, and an engineering service building.

AO Offers Low-Cost Stereophotomicrography

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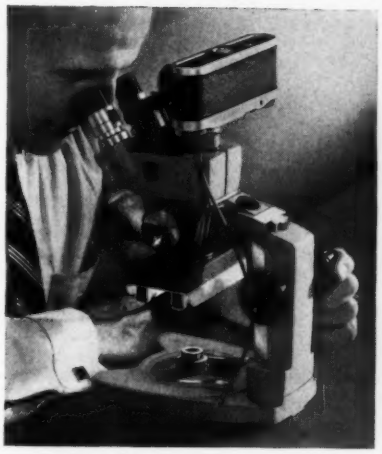
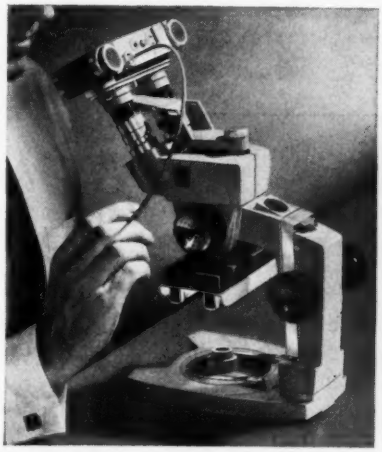
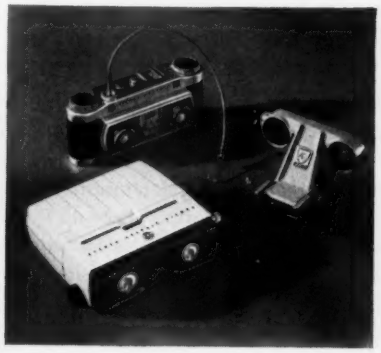


1 SET the focusing adjustment on your AO Spencer Cycloptic Stereoscopic Microscope, to bring specimen into sharp focus. Camera is mounted directly to Cycloptic...out of the way...ready for instant use.

2 SWING the mounted 35 mm Graflex Stereocamera into position over eyepieces. Designed exclusively for Cycloptic, special compensating prisms in adapter unit render camera parfocal with microscopes' optical system. Set camera for bulb exposure. No further adjustment is necessary.



3 SNAP shutter with cable release. You photograph the sharp three-dimensional image exactly as you saw it. Your film processor will supply stereo mounted photographs. Now you have permanent, three-dimensional photomicrographs, in black-and-white or color, for future reference.



The full-size Graflex Stereoviewer, with built-in light source, completes this easy-to-use 3-D photo package. You can review your findings over and over again...anytime ...anywhere. Here is everything you need for three-dimensional photomicrography... unique... easy-to-use. Available only from American Optical.

Ask your AO Sales Representative or write:

American Optical Company
SPENCER
INSTRUMENT DIVISION, BUFFALO 15, NEW YORK

Dept. N-179

☐ Please send full information on AO Spencer 637 Stereocamera attachment.

☐ Also include information on AO Spencer Cycloptic Stereoscopic Microscopes.

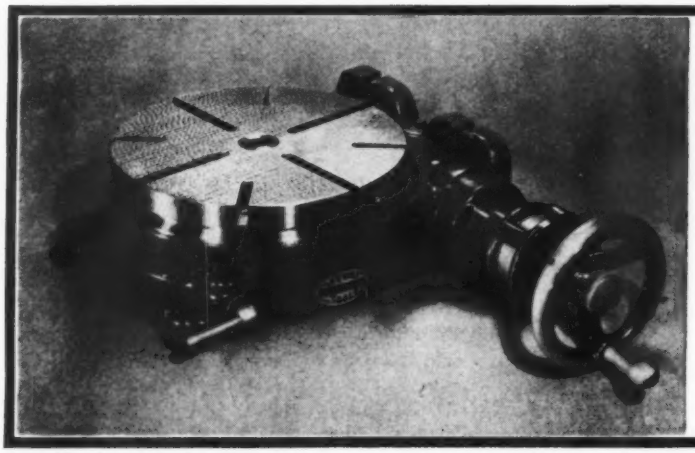
Name_____

Address_____

City_____ Zone____ State____

CIRCLE INFORM-A-GRAM KEY NO. 67

For angular spacing jobs so precise you could never handle them before



A Rotary Table accurate to ±3 sec. in 360°

(USING CHART)

No. 2 Moore 11-Inch Rotary Table, *developed by the builder of the Jig Borer and Jig Grinder.*

THE FOLLOWING ACCURACY BUILT FOR SHOP USE:

All points in 90° increments, from zero, ± 1½ sec.
All points in 18° increments, from zero, ± 2 sec.
All points in 2° increments, from zero, ± 4 sec.
Worm accuracy, ± 1 sec.
Repetition of settings, ± 1 sec.

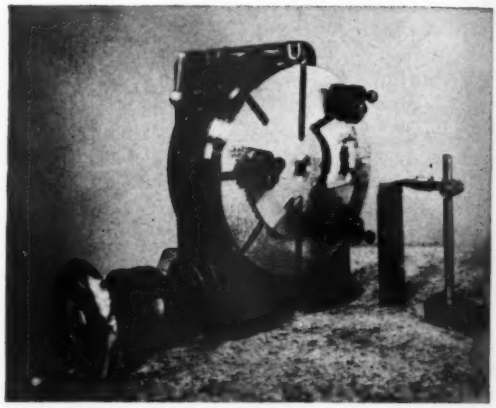
How many jobs have slipped by you because the angular spacing requirements were just too much for your equipment?

With Moore's new 11-Inch Rotary Table, you can easily handle the most precise angular measurements. Having an overall performance accuracy of ± 6 seconds throughout the entire 360°, this table is already being used successfully by several leading companies on government-sponsored precision jobs never before accomplished.

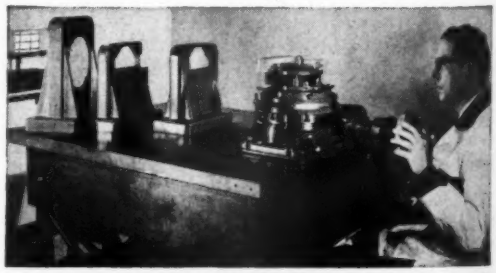
This extreme accuracy is achieved by a non-disengagable, thread-ground worm, combined with accurately spaced teeth of its mating gear. An ultra-sensitive method of angular measurement—interferometric inspection and calibration—used industrially for the first time, assures tooth spacing accuracy within less than ± 4 seconds.

You can use this rotary table for countless precision spacing applications on jig borers and jig grinders. Examples: Spacing holes in a circle on either machine; set at right angle for additional machining and inspection jobs; with its companion unit, the new No. 2 Sine Plate, to produce compound angle settings. Write today for Bulletin RT2.

MOORE SPECIAL TOOL COMPANY, INC.
726 Union Avenue, Bridgeport 7, Connecticut



Accurate in vertical as well as horizontal position. Additional vernier permits normal reading even in vertical position.



Accuracy assured by interferometric inspection and calibration. This is first industrial division of the circle by light-wave measurement.

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTOGRAPH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES

CIRCLE INFORM-A-GRAM KEY NO. 68

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FEBRUARY 1959 ISSUE

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COMPANY ADDRESS _____

CITY _____ ZONE _____ STATE _____

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2	21	59	83	713	892	981	1061	1123	1251
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5	24	64	90	812	913	992	1072	1153	1254
6	25	65	95	813	914	993	1073	1154	1255
7	26	66	100	814	921	1011	1074	1171	1271
8	27	67	105	815	931	1012	1081	1172	1272
9	28	68	111	861	932	1013	1082	1173	1273
10	29	69	113	862	933	1021	1083	1201	1321
11	30	72	114	863	934	1031	1091	1202	1322
12	31	73	116	864	941	1032	1092	1211	1323
13	32	74	118	871	942	1033	1093	1212	1324
14	33	75	119	872	943	1034	1101	1213	
15	34	76	133	873	961	1041	1102	1214	
16	36	77	134	881	962	1042	1103	1231	
17	53	78	701	882	971	1043	1104	1232	
18	54	79	711	883	972	1044	1121	1233	
20	57	82	712	891	973	1045	1122	1235	

EDITORIAL ITEMS

A1	A19	C9	E3	F13	H3	J8	J26
A2	B1	C10	E4	F14	H4	J9	J27
A3	B2	C11	E5	G1	H5	J10	J28
A4	B3	C12	E6	G2	H6	J11	J29
A5	B4	D1	E7	G3	H7	J12	J30
A6	B5	D2	E8	G4	H8	J13	J31
A7	B6	D3	F1	G5	H9	J14	J32
A8	B7	D4	F2	G6	H10	J15	J33
A9	B8	D5	F3	G7	H11	J16	J34
A10	B9	D6	F4	G8	H12	J17	J35
A11	C1	D7	F5	G9	H13	J18	K1
A12	C2	D8	F6	G10	J1	J19	K2
A13	C3	D9	F7	G11	J2	J20	K3
A14	C4	D10	F8	G12	J3	J21	K4
A15	C5	D11	F9	G13	J4	J22	K5
A16	C6	D12	F10	G14	J5	J23	K6
A17	C7	E1	F11	H1	J6	J24	
A18	C8	E2	F12	H2	J7	J25	

Which article in this issue was of most interest to you? _____

THESE INFORM-A-GRAM CARDS are for the convenience of *TOOLING & PRODUCTION* readers who, we know, rarely have stenographic help at their beck-and-call while reading. To get further information concerning selected items featured — all one needs is an INFORM-A-GRAM card and a pencil or pen to circle the numbers of the items wanted. If there is no identifying number, use the page number.

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12	31	73	116	864	941	1032	1092	1211	1323
13	32	74	118	871	942	1033	1093	1212	1324
14	33	75	119	872	943	1034	1101	1213	
15	34	76	133	873	961	1041	1102	1214	
16	36	77	134	881	962	1042	1103	1231	
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A8	B7	D4	F2	G6	H10	J15	J33
A9	B8	D5	F3	G7	H11	J16	J34
A10	B9	D6	F4	G8	H12	J17	J35
A11	C1	D7	F5	G9	H13	J18	K1
A12	C2	D8	F6	G10	J1	J19	K2
A13	C3	D9	F7	G11	J2	J20	K3
A14	C4	D10	F8	G12	J3	J21	K4
A15	C5	D11	F9	G13	J4	J22	K5
A16	C6	D12	F10	G14	J5	J23	K6
A17	C7	E1	F11	H1	J6	J24	
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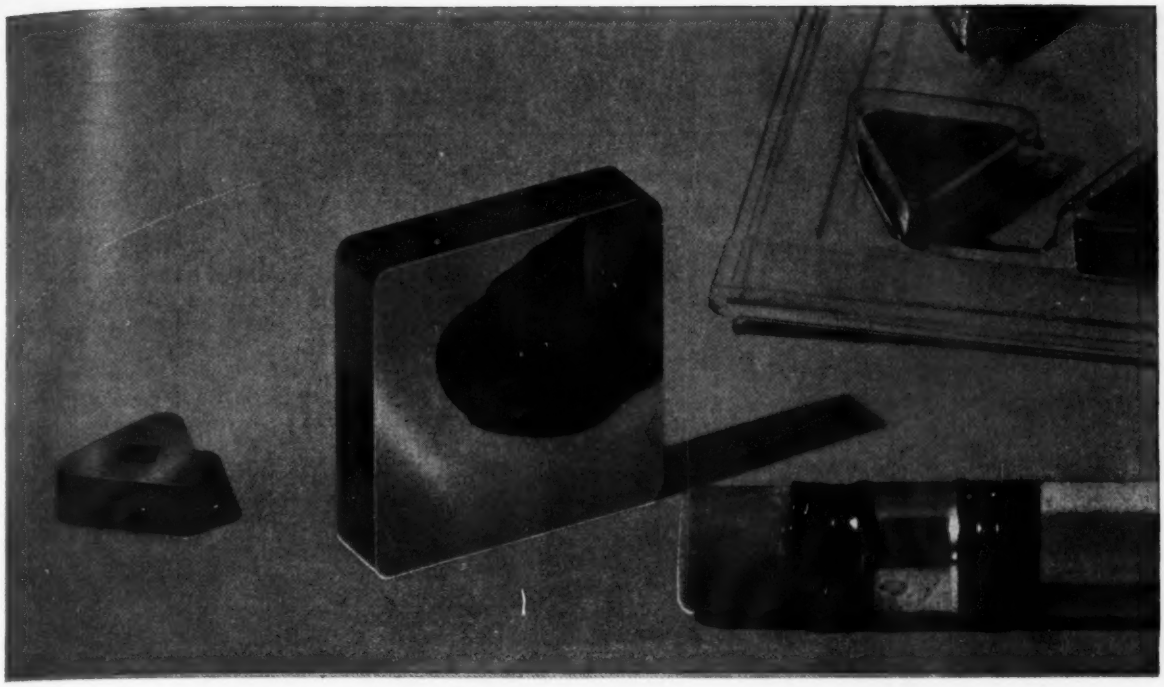
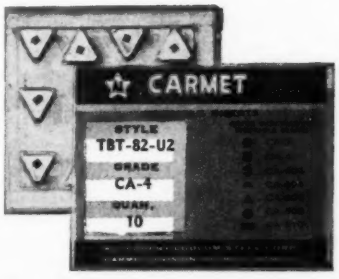


CARMET INDEXABLE INSERTS NOW LAPPED TO A MIRROR FINISH

to reduce chip wear and increase tool life



New Handy Plastic Slide Package

Individual pockets of heavy gauge, clear acetate now make it easy to check your Indexable Insert stock. Slides open for instant dispensing. Cardboard back carries Style, Grade and Quantity numbers plainly stamped. An index of grade markings of Indexable blanks for quick identification is included.

WRITE FOR FREE CATALOG C-16
"Carmet Cemented Carbides for Industry"

This 32-page first edition has prices and complete specifications on Carmet's full line of cemented carbide tipped tools, Indexable Inserts, blanks and holders. Speed and feed charts, grade comparisons, ordering information included.

ADDRESS DEPT. TP-14

Here's another Carmet "first" that cuts machining costs. Top surfaces of Carmet Indexable Inserts in all grades are now lapped with a super-fine grit diamond wheel to a bright mirror finish. And prices stay the same.

Chips just slip by on contact, so cratering and chip wear are reduced to a minimum. This low micro-inch finishing makes cutting edges stronger, too. Burrs and feather edges that contribute to early chipping are actually honed away. Cutting is cooler and more even. The tendency of some materials to stick is greatly reduced. Seating of the insert is highly improved to minimize the hazard of breakage when clamping.

Your Carmet distributor has Indexable Inserts in stock. He knows carbide tooling. Call him for any information you may want on grade selection, tool design or tool holder styles to make your current jobs more profitable. Or write Allegheny Ludlum Steel Corporation, Carmet Division, Detroit 20, Michigan.

WBW-7401

CARMET

CEMENTED CARBIDE DIVISION OF
ALLEGHENY LUDLUM STEEL CORPORATION

CIRCLE INFORM-A-GRAM KEY NO. 69

The HEART of Automation

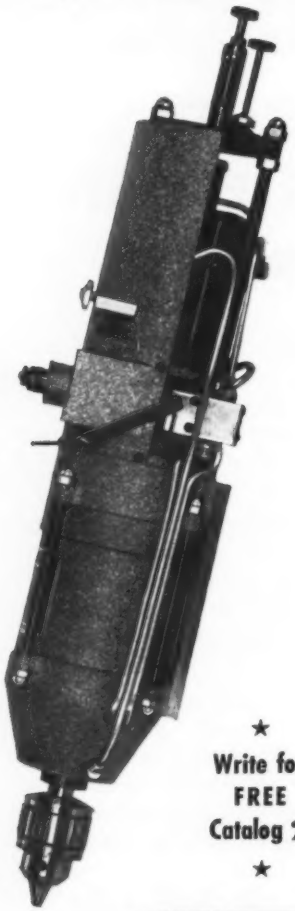
BEDFORD'S

"Rotorized Spindle"

DRILLING UNIT

- MOST RIGID SPINDLE BUILT.
- CONSTANT SPEED and TORQUE.
- POSITIVE EVEN FEED.
- COMPACT! ..... POWERFUL!

... up to 3 HP in a 6" Frame..
... up to 10 HP in an 8" Frame



★ Write for FREE Catalog 20 ★

CIRCLE INFORM-A-GRAM KEY NO. 701

MANUFACTURING MEMOS

No Grease Jobs in 1960 . . . At least one car will have Fiberglide non-lubricated lifetime fabric bearings in 1960, says the American Metal Products Co. Car owners will have one less thing to worry about with these new automotive bearings that make possible maintenance-free automotive steering and suspension, smoother riding, and easier handling. At first the bearings were used on jets (at 10 times the conventional cost), but now that the price meets present bearing competition, the new bearings can be used economically in cars.

Abrasive Advice . . . Having automotive coated abrasive application problems? The Armour Coated Abrasives Division, Armour and Company, has started a nation-wide technical advisory service, staffed with abrasive engineers who will help you with coated abrasive grinding, polishing, and finishing problems. For details, write the company in Alliance, Ohio.

More Carbide Men . . . The first 51-man graduating class of the Carbide Tool Training Program, sponsored by the Los Angeles Chapter of the Society of Carbide Engineers, received diplomas recently. The eight-week program of classes and field trips gave these men basic training in carbide tool application. Guest speaker at the graduating dinner was Philip M. McKenna, president of Kennametal Inc.

Beating the Heat Barrier . . . Republic Aviation Corp. scientists report "substantial progress in beating the heat barrier, still one of the knottiest problems facing manned space flight." Right now they're shooting for a hydraulic system that runs smoothly at 20° to 1,000° F. Space-manned vehicles will be subjected to temperatures as high as 3,000° F upon re-entering the earth's atmosphere from outer space. They now have systems that operate from 20° to 700° F, and another from 230° to 1,000° F. They hope for a combination of the two—20° to 1,000° F—on the next try.

Take Your Pick . . . of the new design engineering service combinations offered by AA Gage Co. The new subsidiary, AA Industries, produces practical and workable designs and they're less expensive to build. Your three choices are: design only, design and build, or build only. Wesley Grizzel is in charge of the new subsidiary. Work out the best plan for you by writing AA Gage at 350 Fair St., Detroit 20, for information.

The Winnah . . . The Richards Memorial Award, sponsored by the American Society of Mechanical Engineers, was recently presented to Donald C. Burnham, vice president in charge of manufacturing for the Westinghouse Electric Corp. The award is "for outstanding achievement within 20 to 25 years of graduation from college."

Dial Indicator Repeatability

The repeatability of "Em-re" Dial Indicators may not be quite as consistent as a photograph—but it comes mighty close! How close? . . . Well, "Em-re" Indicators will repeat consistently to an accuracy of 1/5 a graduation. On a .0001" indicator that's a repeated accuracy of .00002" (twenty millionths).

You need dial indicator performance like this to measure today's increasingly closer tolerances. With an "Em-re" you *can* measure to these closer limits—accurately and dependably. And "Em-re" accuracy permits an operator to use practically *all* of his allowed working tolerance. "Em-re" Dial Indicators are fully jeweled and completely shockproof throughout the entire range. They are now available in all four A.G.D. (American Gage Design) sizes, with 10 ranges from .002" to 1.000" and graduations in .001", .0005", .00025", .0001" and .00005".

Write For New Catalog E

Patented

PETZ-EMERY INC.
PLEASANT VALLEY, NEW YORK

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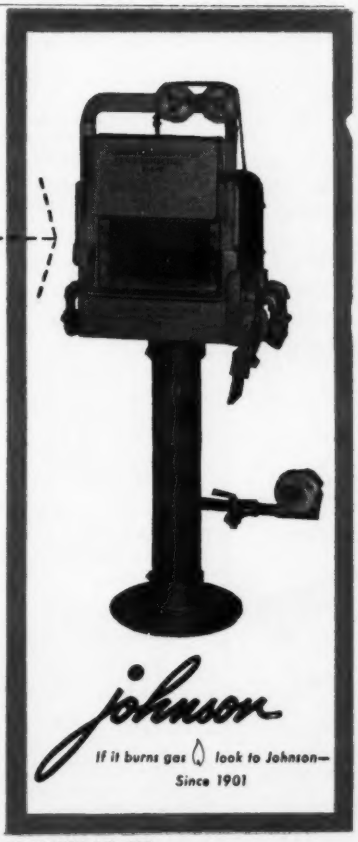
HEATS FAST SAVES TIME



johnson

NO. 142 HEAT TREATING FURNACE

Start heat treating high speed and carbon steels while other furnaces warm up. Powerful burners in this efficient furnace get heat up to 1300°-2350° F. range in minutes. Temperatures accurately and quickly regulated. Ratchet-operated door opens upward — no need to open fully every time. High temperature refractory-lined firebox keeps heat uniform — 7" by 13" by 16½". 200,000 BTU's per hr. Carbofrax hearth, G.E. Motor and Johnson Blower included ..... F.O.B. Factory $358.00

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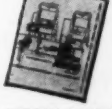

Johnson Gas Appliance Company
575 E Avenue N.W.
Cedar Rapids, Iowa

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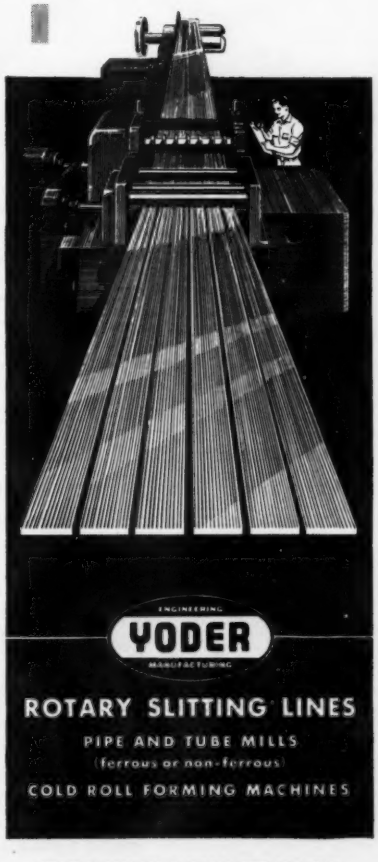
YODER

Rotary Slitters

Product dependability—integrity of manufacture—engineering for specific production needs have all contributed to establish Yoder equipment as the industry standard of excellence. Since 1909 Yoder-built machinery, including Pipe and Tube Mills, Roll Forming Equipment and Rotary Slitters, have earned world-wide customer satisfaction and recognition.

Profit from Yoder's years of engineering and service experience. Send today for the illustrated Yoder Slitter Book.

THE YODER COMPANY
5501 Walworth Ave., Cleveland 2, Ohio



CIRCLE INFORM-A-GRAM KEY NO. 713

BREAK THRU THE COST BARRIER with . . .

Harig

CARBIDE DIES!

✓ LESS DOWNTIME ✓ BETTER STAMPINGS
✓ LONGER LIFE ✓ LOWER COST PER BLANK

Harig Carbide Dies typically out-produce steel dies 10 to 1 per sharpening and per die . . . yet cost only 1.5-2 times more than a steel die. Thus, a Harig Carbide Die affords you *true economy*. Harig is the industry leader because it has the skilled craftsmen and most modern equipment to build a better die.

Harig
EQUIPMENT INCLUDES...

8 Jig Grinders	1 Notching Press
7 Jig Borers	1 Jigmil, cap. 4'x6'
6 Profile & Contour Grinders	9 Universal Grinders
52 Surface Grinders	15 Lathes
6 Tryout Presses	15 Milling Machines
6 Comparators	2 Boring Mills

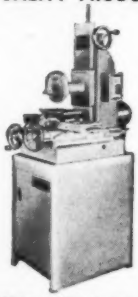
Complete Inspection Dept.

Remember
Harig serves all America . . . so, regardless of location, be sure to contact us for a quotation on your next tooling program.

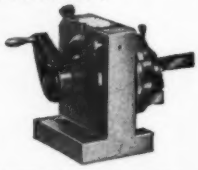
WHATEVER YOUR TOOLING REQUIREMENTS
. . . HARIG IS READY TO SERVE YOU!

- ☐ ENGINEERING
- ☐ DESIGNING
- ☐ CARBIDE DIES
- ☐ LAMINATION DIES
- ☐ PROGRESSIVE DIES
- ☐ MOLDING DIES
- ☐ JIGS, FIXTURE, & GAGES
- ☐ SPECIAL MACHINING

OTHER HARIG QUALITY PRODUCTS



HARIG TML 6x12 SURFACE GRINDER—The Tool & Die Maker's Precision Grinder.



GRIND-ALL FIXTURE—The latest advancement in Perforator Grinding.

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Harig Manufacturing Corp
5761 W. HOWARD ST.
CHICAGO 31, ILL.

CIRCLE INFORM-A-GRAM KEY NO. 72

MANUFACTURING MEMOS

Acquisitions

Two ball manufacturing companies, Strom Steel Ball Co. and Coolidge Corp., have been purchased by Hoover Ball and Bearing Co. The additions boost Hoover's productive capacity about 15%.

The Sheffield Corp. has acquired the drill-making facilities of Cogsdill Twist Drill Co., Inc., and transferred sales and manufacturing to Greenfield, Mass. Stewart Cogsdill acts as consultant to the new Sheffield subsidiary and Roy Heldenbrand is general manager.

The Machinery Division of Hanson-Whitney Co. has been acquired by the Sundstrand Machine Co. The deal covers only the manufacturing and sales rights to Hanson-Whitney thread milling machines.

Name Changes

The new "handle" for The Central Mfg. Division of the Consolidated Electrodynamics Corp. is The Electro Mechanical Instrument Division, with A. P. Struhrman as its director.

In changing its name to Hamilton Cosco, Inc., The Hamilton Mfg. Co. went back to its childhood. Cosco comes from the original company name, Columbus Specialty Co.

Simplification and clarification prompted Snyder Tool & Engineering Co. to switch its name to Snyder Corp.

Representatives

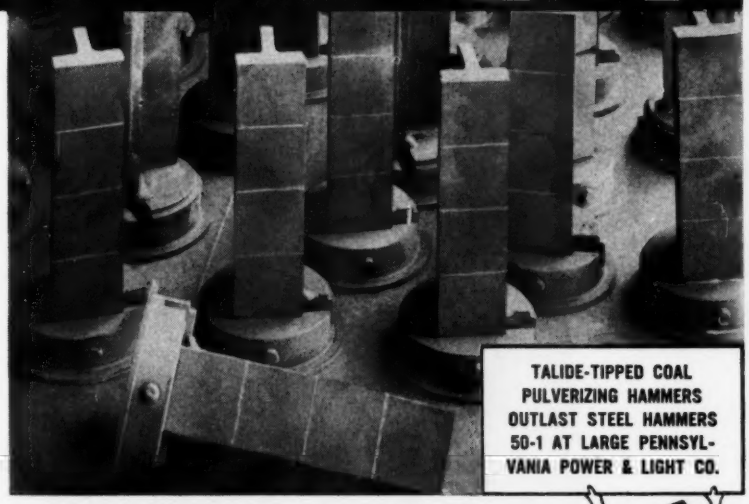
Stanscrew socket screw products of the Standard Screw Co. are being handled by Liberty Industrial Sales, Inc., of Los Angeles.

The Taft-Peirce Mfg. Co. appoints The Tool Crib of Minneapolis to cover Minnesota and part of Wisconsin, and The House of Tools of San Carlos, Calif., to handle northern California and Nevada.

Homestrand, Inc. of Larchmont, N.Y., now handles the Swedish Arboga radial drills and drill presses in this country.

Harrington-Wilson-Daum Corp. of West Hartford, Conn., represents Buhr Machine Tool Co.'s multi-operation machines in eastern New York, northern New Jersey, and Connecticut.

Outlasts Steel 50 to 1!



TALIDE-TIPPED COAL PULVERIZING HAMMERS OUTLAST STEEL HAMMERS 50-1 AT LARGE PENNSYLVANIA POWER & LIGHT CO.

• TALIDE METAL, a tungsten carbide of superior quality, is harder, stronger, and more resistant to abrasion than any other metal. Properly applied, it gives superior service on applications where wear, heat, strain and shock are destructive to other metals.

- **ABRASION RESISTANCE**—Up to 100 times that of steel.
- **COMPRESSIVE STRENGTH**—Higher than all melted, cast or forged metals and alloys.
- **RESISTANCE TO DEFORMATION**—2 to 3 times greater than steel.
- **HEAT RESISTANCE**—Resists oxidation and thermal shock up to 1500°F.
- **THERMAL EXPANSION**—Less than half the rate of steel, "creep" is negligible.
- **FRICTIONAL RESISTANCE**—Lower than steel, non-galling, "slippery" properties higher.

• TALIDE METAL is saving industry millions of dollars annually by wear-proofing vital parts on machine tools, presses, pumps, compressors and other types of processing equipment used in the steel, oil, chemical, plastic, auto, rubber, textile, glass, mining and metalworking industry. The physical properties of the most commonly used grades are listed below. Other grades are available for specialized applications.

PHYSICAL PROPERTIES OF TALIDE METAL (P. S. I.)

Application	Operation	Talide Grade	Rockwell "A" Hardness	Specific Gravity (Density)	Transverse Rupture Strength	Compressive Strength	Co-Efficient of Thermal Expansion	Modulus of Elasticity (Deflection)
WEAR SURFACE	No Shock	C-91	91.8	14.90	235,000	710,000	3.00x10-6	91,000,000
	Light Shock	C-99	91.0	14.75	265,000	670,000	3.65x10-6	84,000,000
	Medium Shock	C-88	89.5	14.55	295,000	635,000	4.00x10-6	80,000,000
IMPACT	Light	C-85	88.4	14.25	315,000	600,000	3.75x10-6	77,000,000
	Medium	C-80	87.0	13.85	335,000	550,000	4.50x10-6	74,000,000
	Heavy	C-75	85.0	13.15	355,000	500,000	5.00x10-6	70,000,000

Note: Hardness values may vary plus or minus .2 to .3 on individual lots.

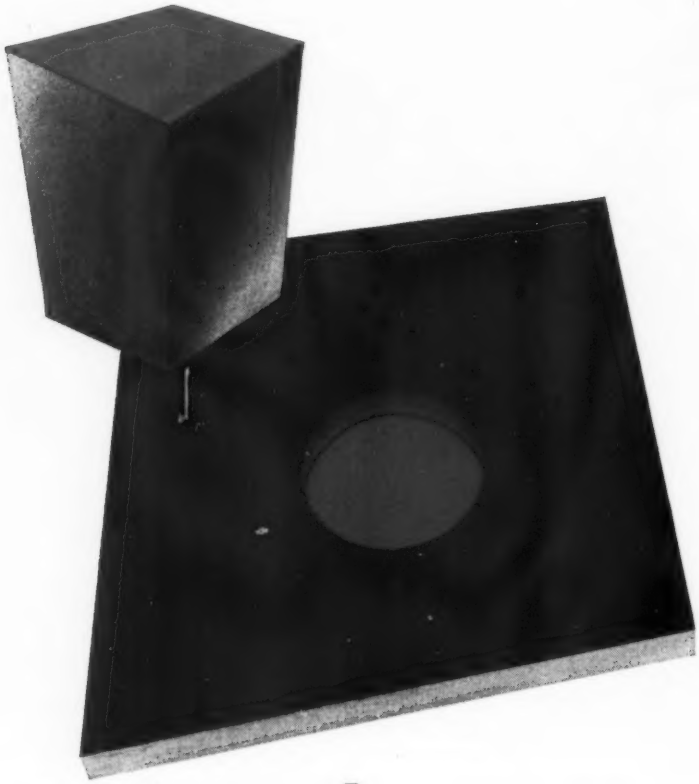
Metal Carbides Corporation Youngstown 12, Ohio

Send for Catalog 56-G

METAL CARBIDES CORPORATION
MC
TALIDE®
YOUNGSTOWN 12, OHIO

HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

CIRCLE INFORM-A-GRAM KEY NO. 73



Inconsistency!

Does anyone expect perfect teamwork between a straight drill and a () barrelled out or a)(bell-mouthed drill guide? Of course not! That's as inconsistent as looking for close tolerance between a square peg and a round hole.

If your drilling operations demand maximum accuracy,
THINK FIRST OF ACE . . .
the proven superior precision drill guide.

There is an interesting "Inside Story" about Ace Drill Bushings. Because the walls, inside and out, are consistently || parallel, this greater drill bearing surface produces better work with longer life of both drill and bushing.

Ace Drill Bushings are made right . . . to wear right. They guarantee a maximum concentricity of .0003" t.i.r. . . . usually it is far less. You can depend upon ACE Drill Bushings. They are consistently **the best** in every way. **Always specify ACE!**

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LOS ANGELES 29
HOllywood 9-8253

ACE

MICHIGAN
10620 West Nine Mile Road
DETROIT 37
Lincoln 8-0777

CIRCLE INFORM-A-GRAM KEY NO. 74

MANUFACTURING MEMOS

Safety in Numbers

For completing one-million man hours of work without a disabling accident, the Parish Division of Dana Corp. was presented recently with a safety award.

Researcher

The University of Cincinnati has appointed Hans Ernst as the Herman Schneider research professor in the College of Engineering. He was formerly director of research at The Cincinnati Milling Machine Co. for 32 years and is now the company's research consultant.

Two-In-One

The American Can Co. announces the consolidation of two former subsidiaries, Sun Tube Corp. and Bradley Container Corp. Now called the Bradley-Sun Division, it has Kenneth M. Leghorn, former president of Bradley Container, as vice president and general manager, and Joseph D. Martin, former president of Sun Tube, also a vice president.

New Society

Space age discussions and quarterly technical presentations are planned for the newly-formed Society of Aircraft Materials and Process Engineers, Eastern Division. Chapters are already established in the west and south. Get details from John S. Thorpe, Application Development Engineer — Aircraft and Missiles, Allegheny Ludlum Steel Corp., Bell Bldg., Tarentum, Pa.

Coming Events

Feb. 3, 4, 5. Reinforced Plastics Div'n of the Society of the Plastics Industry, Inc.'s 14th Annual Technical and Management Conference. Edgewater Beach Hotel, Chicago.

Feb. 5-6. Industrial Management Engineering Conference, sponsored by the Industrial Engineering Dept. of Illinois Institute of Technology, the Engineering Economics Dept. of Armour Research Foundation, and the National Center of Education and Research in Equipment Policy. Illinois Institute of Technology, Chicago.

The FEDERAL DIMENSIONAIR

No adjustment diddling. Set this gage quicker than you can set your watch. Once set, it *stays* set! *It can't drift.*

No need to keep a stockpile of dials. This 7½" *accurately calibrated, all-usable* scale will answer every normal gaging need. Operator cannot change magnification or monkey with your tolerance specifications. Dimensionair is foolproof. To meet the occasional finer or coarser measuring requirements, other magnifications are available.

NOTE: Accurate setting is guaranteed with one master. However, the Dimensionair can be used equally as well *with two* if your standards so specify.

Finger tip attachment. *Longer approach range* lets you see where you are going. *Greater plug clearance* for faster, easier gaging — less wear: No scoring or jamming. *greater exploration* of out-of-round, taper, irregularities. No centralizing error. Deep-set air jets give *longest useful life;* large and *self-cleaning, jets* clean work while they gage.

With this air gage you will measure

More Accurately

More Dependably

Faster (Greater Plug Clearance)

With Less Maintenance Cost

With Less Dependence on Skilled Help

than with any other air gage you can buy!

This is a statement we are ready to prove. Don't take our word for it. *Try* the Dimensionair on a "no-strings-attached" trial basis. Mail the coupon today.

Ask FEDERAL *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic—for Inspecting, Measuring, Sorting, or Automation Gaging

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OK Prove it! *Let us try a DIMENSIONAIR*

Name .....

Company .....

Address .....

CIRCLE INFORM-A-GRAM KEY NO. 75

MEN YOU SHOULD KNOW

Logansport Machine Co., Inc., makes known the election of **Mrs. E. P. Wilkinson,** former president, to chairman of the board of directors, and **F. B. Wilkinson** from vice president to president.

New chief tool engineer of the Warner Electric Brake & Clutch Co., is **Harold A. Weiss.**

R. C. Rieder, works manager of Baker Perkins Inc., was elected vice president of manufacturing by the board of directors.

Lipe-Rollway Corp.'s new president is **John D. Williams.** He succeeds **H. Follett Hodgkins, Sr.** who is serving as chairman of the board. Other changes include **Robert M. Zimmerman,** vice president of Lipe-Rollway, and **H. Follett Hodgkins, Jr.,** vice president of Rollway Bearing Co., Inc., a wholly-owned subsidiary.

LOOK!

LOGAN HAS IT!

RIGHT PRICE
TOP QUALITY
PEAK PERFORMANCE

In hydraulic power devices

LOGANSPORT MACHINE CO., INC.
844 CENTER AVENUE, LOGANSPORT, INDIANA

PLEASE SEND COPY OF CATALOG:
☐ 100-1 AIR CYLINDERS
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☐ 200-4 AND 200-7 HYD. VALVES
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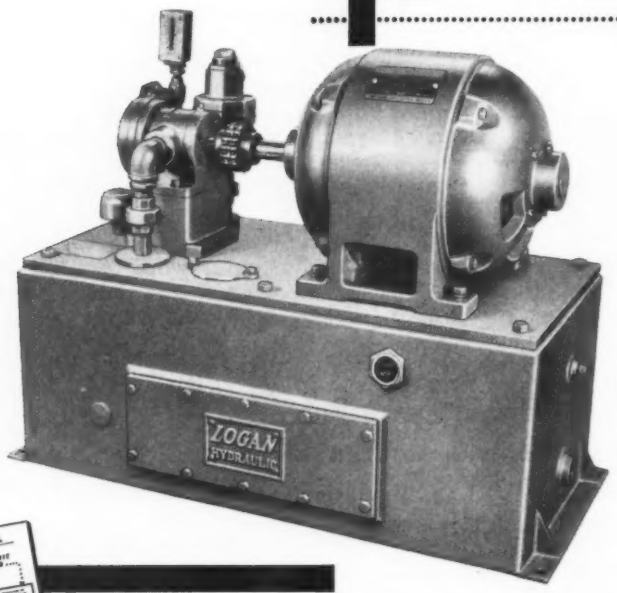


FREE SEND FOR YOUR COPY OF THE LOGAN "CIRCUIT RIDER"
A 32-page manual on fluid power circuits (fifth edition) completely revised to present current engineering trends.

MEMBERS: Nat'l. Mach. Tool Builders' Assn.; Nat'l. Fluid Power Assn.

ILLUSTRATED—LOGAN MODEL 4031 HYDRAULIC POWER UNIT

CIRCLE INFORM-A-GRAM KEY NO. 76

Taking over as chief engineer for automotive products for AC Spark Plug Division of General Motors is **Dr. Wilfred A. Bychinsky.**

Newly elected officers of the B. C. Ames Co. include **Henry G. Haynes,** president; **Bliss C. Ames,** vice president; **Warren Ames, Jr.,** vice president; and **Henry G. Haynes, Jr.,** treasurer.

The Timken Roller Bearing Company's board of directors has elected **Herchel M. Richey** vice president in charge of manufacturing at their Roller Bearing and Rock Bit Divisions. He fills the vacancy left by the retirement of **A. M. Donze,** who continues as a member of the board of directors. Taking over as general factory manager, Richey's former position, is **Henry A. Tobey.**

Recently appointed manager of tool engineering and metal fabrication for Philco Corp.'s Government and Industrial Division, is **Henry J. Egen, Jr.**

Veeder-Root Inc.'s board of directors elected **Harvey L. Spaunburg** chairman of the board and **Wilbur C. Strauble,** president. The new board chairman was formerly the company's president, and the new president continues also as president of The Holo-Krome Screw Corp., a wholly-owned subsidiary.

Two promotions and a new appointment in the engineering department of The Barden Corp. have been announced. **Lewis W. McKee,** formerly assistant chief product engineer, is the new chief product engineer; **John J. Murphy,** former research coordinator, is now contract research manager; and **Kenneth D. Mackenzie** has joined Barden as advanced product manager.

Walter W. Tangeman, having completed 50 years of service with The Cincinnati Milling Machine Co., has retired as chairman of the board but will continue as a director. Taking his place is former president **Frederick V. Geier.** Swan E. Bergstrom, former executive vice president, was elected president.

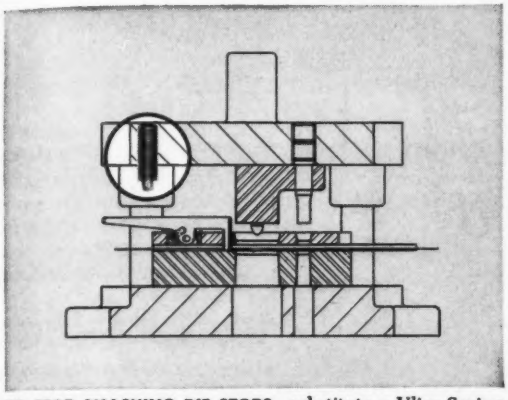
Hevi-Duty Electric Co. announces these appointments following the acquisition of Stroman Furnace and Engineering Co.: **Jack L. Stroman** serves as furnace consultant; **J. C. Smith** handles sales; **John Denzien,** is senior design engineer; and **Harry R. Kaht, Jr.** assists in the sales department.

. . . Continued on page 78

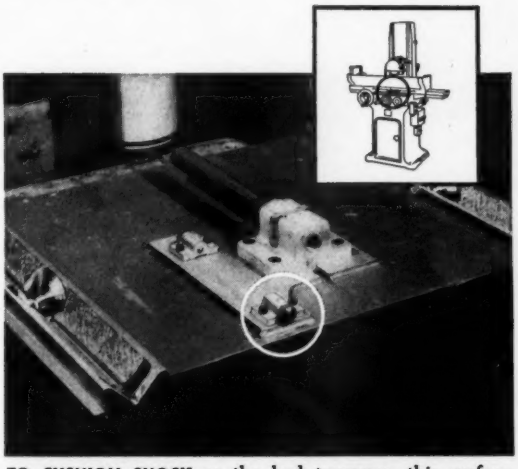
Practical Tooling Tips

Number 2 of a series.

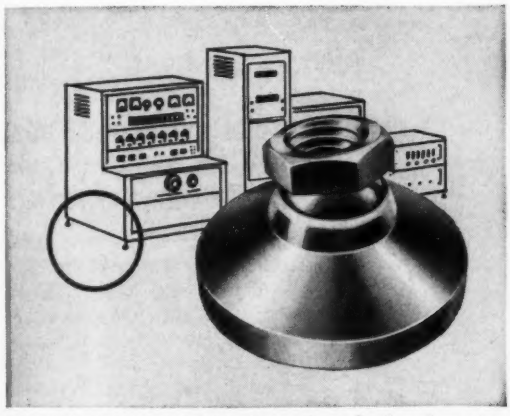
Substituting simple, off-the-shelf Vlier Tooling Accessories for complicated, custom-made devices in both tooling and original equipment applications can result in important savings. Why not put them to work in your plant?



TO STOP SMASHING DIE STOPS, substitute a Vlier Spring Plunger for the usual square-head screw. The plunger actuates the automatic stop perfectly and, unlike the screw, never needs adjusting no matter how many times the die is resharpened. Available in four models: 50 sizes.



TO CUSHION SHOCK as the bed traverses, this surface grinder manufacturer uses two Vlier Spring Stops, reducing wear and tear on the machine. These clever, spring-loaded devices, ordinarily used on fixtures where the absence of side walls prevents the use of spring plungers, are now available in three standard sizes: 3 end pressures. Special sizes made to quantity orders.



TO LEVEL MACHINE TOOLS, electronic racks, benches, etc., use the *standard* Vlier leveling pad. The pad swivels to 7½° each side of the center line; adjusts automatically to uneven surfaces. Unique ball-joint design distributes weight over entire pad surface.

TO GET NEW IDEAS on how to save with Vlier Tooling Accessories, send for new 28-page booklet "Typical Applications of Vlier Tooling Accessories." It suggests dozens of ways to use these time-savers in both tooling and original equipment applications. Write for your copy today.

New catalog now ready! Send for your copy today.

Insist on Vlier Tooling Accessories... there's still no substitute for quality!

VLIER ENGINEERING INCORPORATED

A subsidiary of Barry Controls, Inc.

8900 Santa Monica Blvd., Los Angeles 46, California

CIRCLE INFORM-A-GRAM KEY NO. 77

. . . **Men from page 76**

Moving up from vice president and general manager to president of The Cleveland Punch & Shear Works., is **William J. Stewart.**

George Stern recently joined Nuclear Development Corporation of America as manager of the materials department.

New chief engineer for the Electro Mechanical Instrument Division, Consolidated Electrodynamics Corp., is **John P. Moffat, Jr.** He was formerly director of quality control for the division.

Roland Lehr, president of Baker Brothers, Inc., has been elected to the additional post of president of Gear Grinding Machine Co.

Gregory Industries, Inc., has announced the election of **Leonard C. Barr** as executive vice president and the advancement of **Richard E. McGinnis** from field sales manager to vice president of sales; **George E. Gregory, Jr.**, from controller to financial vice president and treasurer; and **Robert J. Kilmer** from financial vice president and treasurer to vice president of trade relations.

NEW!
Eclipse
PORT CONTOUR CUTTERS
A.N.D. 10050
Eclipse
PORT CONTOUR CUTTERS
WITH
PRECISION GROUND FORMED RELIEF
INSURE
• LONGER LIFE • FINER FINISHES
and • ARE EASILY RESHARPENED
H.S.S. AVAILABLE FROM STOCK
Other types of form ground port contour cutters are made by Eclipse in both H.S.S. and T.C.T. for special machining operations.
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ECLIPSE COUNTERBORE COMPANY
1600 BONNER AVE., DETROIT 20, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 78

REPLACEMENT OF POWER CYLINDER SEALS SIMPLIFIED

A new method of replacing certain types of power cylinder seals has been developed by the Miller Fluid Power Division of Flick-Reedy Corp. for use on its Job-Rated hydraulic cylinders for 500 to 2500 psi service and its Power-Packed hydraulic cylinders for 3000 to 5000 psi service.

Since standard commercial machine tool type hydraulic cylinders are available in up to 12 piston rod diameters (from ⅝" through 5½") and in up to 11 bore sizes (from 1½" through 14"), full line replacement of these two types of seals would, by present replacement practice, require the cylinder user to carry replacement seals in up to 23 different sizes. The new method reduces the maximum replacement requirements to only two sizes.

Miller accomplishes this by making both seals available in strip form on spools. To replace either seal, cut off a section of the seal strip (with knife or scissors) to required length and insert the cut strip in proper groove.

The strip seal material on the spools is made of the same material as the original cylinder seals — milky white Teflon, widely known for its immunity to high temperatures and its compatibility with all hydraulic fluids.

THREE-SPINDLE UNIT DOES JOB OF FOUR MACHINES

Rough and finish boring and facing of rocker levers, formerly done with four machines and three operators at Cummins Engine Co., is now done by the company with one machine and a single operator. The 3-spindle Heald Bore-Matic designed for the job has a 2-station hand clamping fixture which is indexed hydraulically in front of the three spindles.

One part is completed at each cycle. With the fixture indexed front and both stations loaded, the front boring head roughs the bore and finishes the bottom face of one part with a 2-fluted cutter while the center head finishes the bore of another part using a single-point tool. The operator then replaces the finished part at the rear station with a new part and indexes the fixture to the rear. There, one part is finish-bored by the center head while the rear head roughs the bore and finishes the face of the new part.

HARDINGE
ELMIRA, N.Y.

EASY READING HARDINGE BLACK AND WHITE DIALS

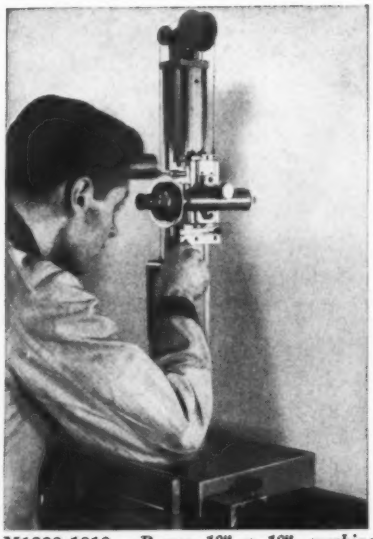
MEAN INCREASED PRODUCTION . . .

. . . **HARDINGE** developed these fast setting easy reading **black and white dials** — they assure maximum accuracy with high production.

Pioneered with the Hardinge High Speed Precision Tool Room Lathe model HLV shown here — **Hardinge black and white dials** are now standard equipment at **no extra cost** on all of our tool room and production machines.

Invest in Hardinge equipment for product improvement and increased production. Ask for bulletin on our tool room and production machines.

HARDINGE BROTHERS, INC.
ELMIRA, N. Y.



M1238-1818 — *Range 18" x 18", working distance 9" to infinity. Reads to 0.001" up to 24" working distance. Protractor ocular reads to 3 minutes of arc. Image is erect.*

Cut inspection time in half

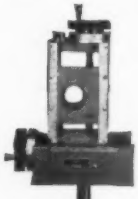
with new Gaertner Coordinate Cathetometers

These convenient, reliable optical instruments permit making precise coordinate measurements in a vertical plane. The two dimensions are measured with one setting, object does not have to be rotated. Inspection time is cut in half and resetting errors eliminated.

Versatile Gaertner Coordinate Cathetometers are ideally suited for precision measurements on large objects; also objects or points in recessed, remote, or inaccessible locations. Applications include measuring jet engine sections, complicated castings, printed circuits, bolt holes and bosses on large piece parts, traces on cathode ray tubes, etc.

Because these are optical rather than mechanical measuring instruments, you make non-destructive measurements without contact, distortion, or concern about pressure being applied to the object when making a setting. Instruments available in English or Metric system.

M1236-46 — Horizontal range 6", vertical range 4". Reads to 0.0001", working distance 5" to infinity.



M1236-22 — Range 2" x 2", reads to 0.0001". Working distance 5" to infinity. Shown with 19 mm mounting rod, and without telemicroscope. Instrument permits precise coordinate movement of other objects such as photo cells, probes, etc., in place of telemicroscope.

Write for Bulletin 188-53 & 194-57

The Gaertner Scientific Corporation

1242 Wrightwood Ave., Chicago 14, Ill.
Telephone: BUckingham 1-5335
CIRCLE INFORM-A-GRAM KEY NO. 801

Products & Processes

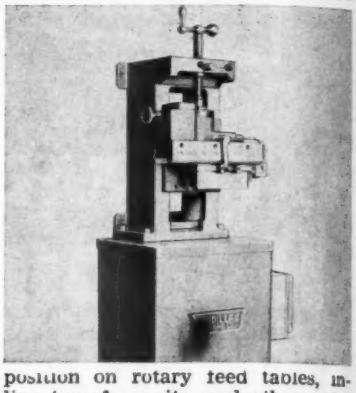
PRODUCTS & PROCESSES & PRODUCTS & PROCESSES & PRODUCTS & PROCESSES & PRODUCTS

Automatic Controlled Parts Feeders, orientors, and conveyors for high speed parts handling, machining, and fabricating are explained in a bulletin. Dimensions for different models are given in chart form and detailed diagrams show comparisons. Radio Corp. of America, 13541 Auburn Ave., Detroit 23, supplies copies of the bulletin, or Circle Inform-A-Gram No. A1.

A New Wet Abrasive Cut-Off Machine is described in a bulletin which tells how Model 481 provides the cutting speed and the accuracy for high production schedules when anything solid billets, pipe, or other shapes that fit into an 8" circle or square. Bulletin DH-84 is prepared by American Chain & Cable Co., Inc., 929 Connecticut Ave., Bridgeport 2, Conn., or Circle Inform-A-Gram No. A2.

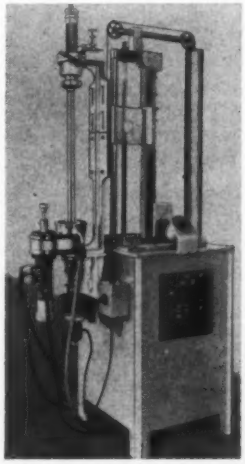
Custom-Made Shims of Aluminum in two lamination thicknesses are featured in a catalog which also gives specifications for stainless, mild steel, and brass shims. The aluminum shims are available with lamination thickness of 0.002" or 0.003". Write to Laminated Shim Co., Glenbrook, Conn., for a copy of "Revised Engineering Data," or Circle Inform-A-Gram No. A3.

This Standard Packaged Unit for hydraulic roll marking can be mounted at any angle. Model 58U's roll marking principle permits marking parts while in a fixtured



position on rotary feed tables, in-line transfer units, and other automated setups. Get details from Cadillac Stamp Co., 17301 Ryan Rd., Detroit 12, or Circle No. A4.

The Murex Hard Surfacing Fact File lists over 88 types and sizes of Hardex electrodes with descriptions, physical properties, chemical analyses, and two electrode selectors. The data is listed on cards for quick accessability. Get your file from Metal & Thermit Corp., Rahway, N. J., or Circle Inform-A-Gram No. A5.



A New Floating Zone Fixture for the production of ultra-high purity metals and semi-conductor materials has been introduced by Lepel High Frequency Laboratories, Inc., Woodside, N. Y. Purification or crystal growing is achieved by traversing a narrow molten zone along the length of the process bar while it is being supported vertically in vacuum or inert gas. Model HCP features a smooth, positive mechanical drive system with continuously variable up, down, and rotational speeds, all independently controlled. For additional information, write to the company, or Circle Inform-A-Gram No. A6.

Fabricate Shapes and Apply Coatings with the new Linde method that maintains temperatures as high as 30,000°F. The Plasma Arc Torch handles pure tungsten, molybdenum, zirconium, tantalum and carbide materials. The metal or substance to be worked is prepared in wire or power form, passed through the intense arc inside the torch, melted at 15,000°F, and carried out by inert gases at such force that it bonds firmly. Write to Linde Co., Div'n of Union Carbide Corp., 300 Madison Ave., New York 17, for a bulletin or Circle No. A7.

For increased production and better finish!

HELICARB

HELICAL CARBIDE CUTTERS

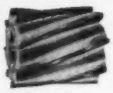
Now standard in these types!

Shell mills

End Mills and Adapter

Staggered-tooth Side Mills

Interlocking Side or Straddle Mills



Slab mills

Write for catalog and name of your nearest distributor.

Special tools designed with "Helicarb" principle.

SONNET
TOOL AND MANUFACTURING COMPANY
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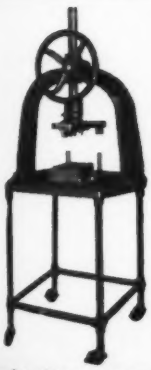
The original line of standard Helical Carbide tools

CIRCLE INFORM-A-GRAM KEY NO. 811



COMPLETE THE DIE-SET AT YOUR BENCH

Lacey Die-Set Machine

Here's a truly "one man" press. It operates with one hand. Handy for tool and press rooms, it permits the die-maker to complete a die-set at his bench . . . saves toolroom and handling costs. Ask today for full details.

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CIRCLE INFORM-A-GRAM KEY NO. 812

CAMS ALL TYPES MADE TO YOUR SPECS

Dr. Chas. Eisler ME, Founder
Chas. Eisler, Jr., Pres.

EISLER ENGINEERING CO., INC.
739 SO. 13TH ST. NEWARK 3, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 813

TOOL CONTROL SYSTEM

Now, from Seibert, you can obtain tool control boards that are individually designed to suit your production requirements. Panels are subdivided into sections for each type of tool, and divisions are arranged as required with space for two sets of tools for each job. Tool panels and benches are available in 3, 6, 9 or 12-foot lengths. In addition, you can now obtain from Seibert pre-setting gages of all types and also optional equipment such as plastic cyclometer covers with locks, drawers, shelves, etc., to suit your specific needs.

INCREASES PRODUCTION EFFICIENCY

Tool Control Boards are a tested and proven method of increasing the efficiency of production machine tools. They provide a system of scheduling tool changes according to pre-determined efficiency standards. You cut down-time, insure longer tool life, reduce tool breakage, and lower scrap losses.

SUMMARY OF ADVANTAGES

- Reduces down-time, provides an efficient system of programming tool changes.
- Automatically controls machining operations; provides visual record of used life of each tool.
- Assures more efficient use of tools, reduces breakage and scrap losses.
- Provides storage and complete facilities for presetting tools at the machine.

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QUALITY MULTIPLE DRILL SPINDLE AND PRODUCTION TOOLS

CIRCLE INFORM-A-GRAM KEY NO. 814

TIME SAVERS for the TOOL ROOM

. . . and the production line

Do It Faster With A DREMEL MOTO-TOOL

For top-speed, top-precision grinding, polishing, and burring, low-cost Dremel Moto-Tools are your best practical buy. Use them in tool and die work, pattern making, burring operations, and dozens of other applications. They're light and easy to handle. Give you quick access to areas inaccessible for larger grinders. Cool-running universal motor develops 27,000 RPM. Smooth operation permits precision accuracy in close-tolerance work, eliminating costly and painstaking hand work.

Model No. 2 Moto-Tool only **$19.95**

Model No. 2 Moto-Tool Kit, with 23 accessories, including high-speed cutters, in steel storage case **$27.50**

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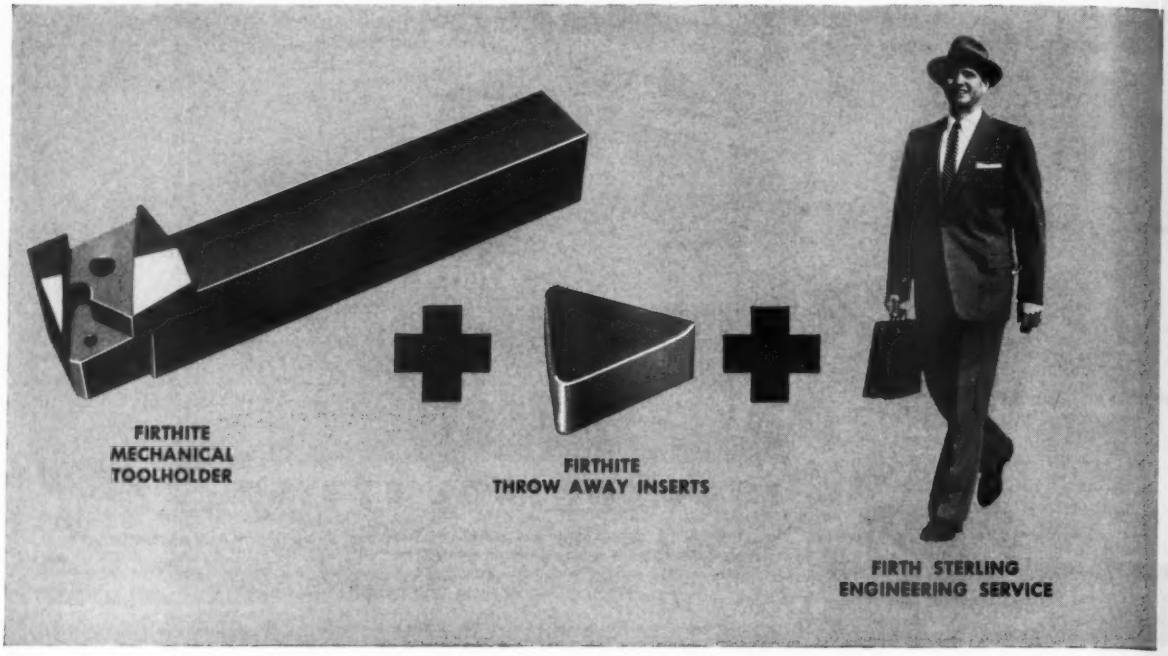

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There are two important reasons why thousands of metalworking plants are cutting costs with Firth Sterling mechanical toolholders, throw away inserts and engineering service. First, the broad experience and expert application knowledge of Firth Sterling engineers (yours at no cost) help you plan your tooling program for maximum savings. Second, in this complete line, Firth Sterling has toolholders and inserts—*exactly* right for *your* job:

THRIFTOOL— lowest cost toolholder made. Offers chipbreaker, rigid insert and rapid indexing for reduced set-up time.

ECONODEX— medium priced holder is ideal for jobs requiring positive rake. Carbide anvil and carbide chipbreak clamp assure long life.

MECHANIDEX—for heavy-duty machining. Adjustable chipbreaker offers extreme versatility, allowing top and bottom indexing of inserts.

FIRTHITE INSERTS—most precise dimensionally—are available in a full range of Carbide grades and the new Firthite Cermet WF Grade. *Now available for the first time, high speed steel throw away inserts in two of Firth Sterling's top cutting grades—Circle C and Van Chip.*

To get help with *your* tooling problem from a Firth Sterling engineer, simply call your nearest Firth Sterling sales office or distributor. And for further information on Firth Sterling toolholders and inserts, write for descriptive bulletin MTI-3: FIRTH STERLING, INC., Dept. 100, 3113 Forbes St., Pittsburgh 30, Pa. Offices and warehouses in principal cities.

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These Automatic Vertical Balancing Machines are for either one or two plane balancing (static or dynamic), and are especially suited for disc-shaped parts such as flywheels and fans, for which tooling problems and loading and unloading of

the workpiece are much simpler than on horizontal machines. Five available sizes come in 0.5 to 1100-lb capacities. Cosa Corp., 405 Lexington Ave., New York 17, N. Y., or Circle Inform-A-Gram No. A8.

Horizontal Hydraulic Feed Units for drilling and tapping are detailed in a catalog which explains and illustrates design features. Charts containing data on arm-type adjustable spindles, slip-type spindles, and spindle speeds are given, as well as suggested floor plans. For Catalog 619, write Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio, or Circle Inform-A-Gram No. A9.

A Portable Coolant Blender is capable of dispensing varying mixes of water-soluble coolants at the machine. The two displacement pumps are linked to metering valves to

allow infinite selection of coolant mixes. M. J. French Co., Inc., P. O. Box 23, Brighton Station, Rochester 10, N.Y., or Circle Inform-A-Gram No. A10.

A Closed-Circuit TV System is now available with built-in fully automatic light adjustment control with variations up to 1000:1. Model 1986 is suited to applications where lighting conditions are subject to rapid change. Kin Tel, Div'n of Cohu Electronics, Inc., 5725 Kearny Villa Rd., Box 623, San Diego 12, Calif., or Circle No. A11.

A Line of Thin-Section Ball Bearings, made in precision and ultra-precision grades, is listed in a 24-page catalog. The "T" Series comes in 12 sizes from 0.6250" bore and 1.0625" OD through 3.0625" bore and 3.8750" OD. Copies are available from Split Ballbearing, A Div'n of MPB, Inc., Lebanon, N.H., or Circle Inform-A-Gram No. A12.

Use Only One Metal Type holder for either hand stamping or punch press stamping operations. This "2-in-1 Typeholder" features one-piece construction, and heat treated platen type seat which maintains consistently even type impressions. Acme

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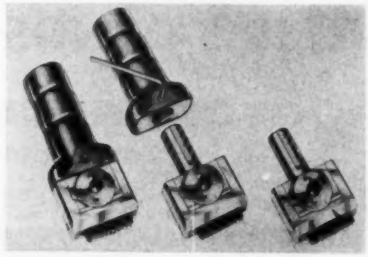
Marking Device Co., 1149 E. Pico Blvd., Los Angeles 21, or Circle Inform-A-Gram No. A13.



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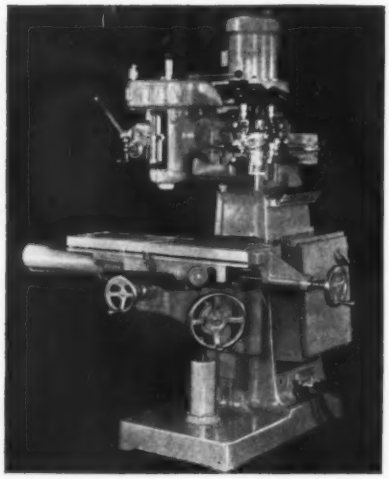


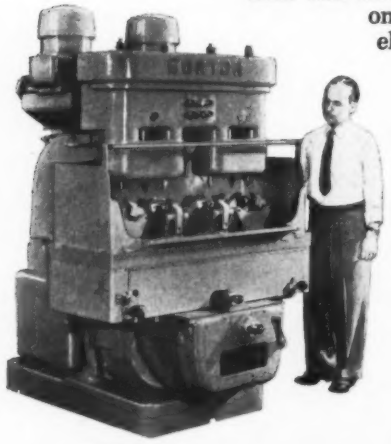
from 8 Hours per piece to 5 Minutes per piece

This standard Gorton Trace-Master Hydraulic Duplicator was purchased to profile a complex part from a simple master. Previous cost of this operation was $102.40. Present cost with this Gorton machine is $1.07. Saving per piece is $101.33.

*Cost figures were arrived at by using $2.80 per hour for operator's time and $10.00 per hour, Machine rate.

cost saving per piece . . . $1,139.20

This Gorton Horizontal Mill with special holding fixture, tooling, hydraulics, etc., was purchased to machine thirty-five impeller blades from the solid, involving compound curvatures, thicknesses and depths. Former production time was one piece in 100 hours. Present time on this new machine is one piece in eleven hours. Machine was paid for after machining 22 pieces.



$50,000 machine pays for itself in 41 Weeks

This Gorton 4-spindle "Automatic Cycle" Duplicator was purchased to mill out recesses in a round steel part. Original production time on a manually operated single spindle duplicator was 60 pieces per hour. Present production on this new machine is 204 pieces per hour. Cost saving is 71%.

Cost reduction and improved accuracy are important to you today. We shall be glad to analyze your needs and make specific recommendations on request.

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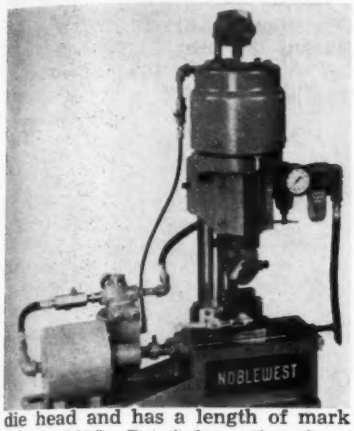
Tracer-Controlled Pantographs, Duplicators — standard and special . . . Horizontal and Vertical Mills, Swiss-Type Screw Machines, Tool Grinders, Small Tools and Accessories.

AB-1012

CIRCLE INFORM-A-GRAM KEY NO. 84

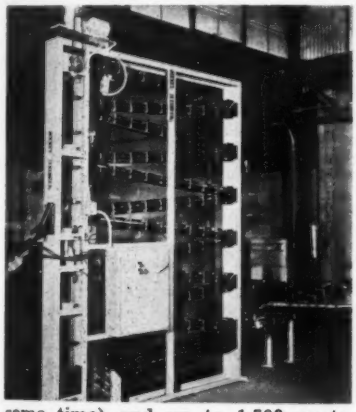
For Marking Steel, brass, aluminum, and other metals, use this new all-pneumatic bench model marking machine from Noble & Westbrook Mfg. Co., E. Hartford 8, Conn. Model 501 is equipped with an air-operated



die head and has a length of mark up to 2½". Get information from the company, or Circle Inform-A-Gram No. A14.

New Strippable Vinyl Coatings to protect and moisture-seal metals and finishes is discussed in a bulletin. It suggests application techniques, stripping, and some of the uses of Pensalt X 1000. Get your copy from Pensalt Chemicals Corp., 3 Penn Center, Philadelphia 2, or Circle No. A15.

A Demand-Feed Storage Unit for pipe fittings or other rolling parts was designed for use in an automated processing line. It'll handle three different sizes (not at the



same time) and up to 1,500 parts, depending on the size of the part. Gear-O-Mation Div'n, Michigan Tool Co., 7173 E. McNichols Rd., Detroit 12, or Circle No. A16.

A New Flexible Shaft Machine Catalog includes information on flexible tool and power shafts used for grinding, sanding, drilling, and polishing. Specifications are listed in chart form for easy selection. Catalog 59 is available from Stow Mfg. Co., 443 State St., Binghamton, N.Y., or Circle Inform-A-Gram No. A17.

A Design Tracing Template Package contains over 14 different drawings, for breadboard layouts, prototypes, design production, technical sketching, and detail part drawings. They show gears, dials, cams, differentials, shafts, and speed reducers. Write to PIC Design Corp., 477 Atlantic Ave., E. Rockaway, L. I., N. Y., or Circle Inform-A-Gram No. A18.

Guard Inserts and Spacers against nicks and loss by using this hardwood type case with Masonite cover and bottom. It contains fifty 1¼" x 1½" recesses to hold different small items. Geo. T. Schmidt, Inc., 4112

Products & Processes

N. Ravenswood Ave., Chicago 13, or Circle Inform-A-Gram No. A19.

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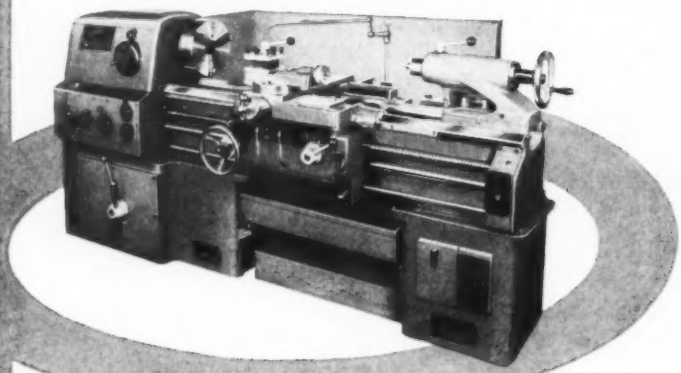

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Jaws for holding non-magnetic material on magnetic chucks

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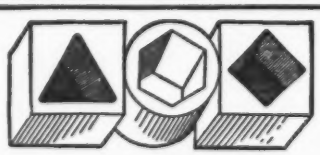

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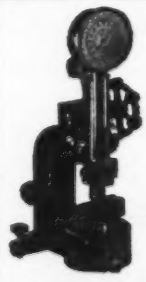

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Toolroom

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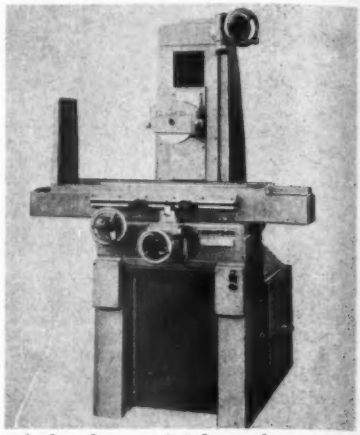
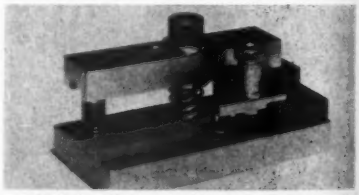
Ruggedness and Great Rigidity has been combined with the super sensitivity and easy operation in the new Type D hand feed surface grinder. Designed for general toolroom grinding, this Thompson



grinder has a total work area of 6" x 14" x 18" and features a bearing quill supported solidly through its entire length to assure closer tolerance work. For details, Circle Inform-A-Gram No. B1.

Save Layout Time, eliminate detailing, and cut tooling cost using the "Standard Templates" catalog from Northwestern Tools, Inc., 116 Hollier Ave., Dayton 3, Ohio. Over 200 components for jigs and fixtures, all in full scale, are presented in this catalog. Get your copy from the company, or Circle No. B2.

Stainless Steel Hardened and Heat-Treated Tool Clamps come in a complete range of sizes for a wide variety of tools, jigs, and milling fixtures. Sliding swivel, flat sliding, and swinging taper nose styles are



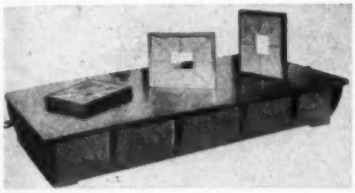
available. Get a tool component catalog from PIC Design Corp., 477 Atlantic Ave., E. Rockaway, L.I., N. Y., or Circle No. B3.

"Portable Pneumatic Production Tools" contains dimensions for 4" to 8" horizontal grinders, wire brushes, and accessories. Organic bonded grinding wheels in straight, flared cup, cone, and depressed center types are also listed. Ask for Catalog PT-58 from Thomas C. Wilson, Inc., 21-11 44th Ave., Long Island City 1, N. Y., or Circle Inform-A-Gram No. B4.

Low Cost, Precision Ground Angles, bases, and columns for use in the construction of jigs, fixtures and special purpose machines, have been announced by The Grimes Engineering Corp., 1187 College Hwy., Cheshire, Conn. These mounts, available in standard lengths from 4" to 36", can be ordered blank or drilled, tapped, and machined to suit requirements. Write the company for Bulletin 458-M, or Circle Inform-A-Gram No. B5.

Holding Devices for high speed production are outlined in a bulletin from Heinrich Tools, Inc., Racine, Wis. Jaw widths of these screwless vises range from 3" to 8". Complete specifications are given in chart form. Get this catalog from the company, or Circle Inform-A-Gram No. B6.

A New Type Square features the versatility of both a square and a parallel. It's designed of meehanite for long lasting accuracy, with all edges and sides hand scraped



to a tolerance of 0.0001" in squareness and parallelism. Get more information from J. C. Busch Co., 175 S. Barclay St., Milwaukee 4, or Circle Inform-A-Gram No. B7.

Determine Fixture Locations when loading or unloading work with this improved line of expanding locators. Three different types come with cam lever actuation, hand knob actuation, and wrench or draw bar actuation. Sizes range for use in bores from ⅜" to 11". Bulletin 27 is available from Speedgrip Chuck, Elkhart, Ind., or Circle Inform-A-Gram No. B8.

Solve Frictional Heat Problems with plastic tooling by using the Ceram-A-Grip drill bushing that features an outer ceramic shell to insulate plastic potting from excess frictional heat build-up in the bushing. It reduces bushing misalignment and spin out. Literature is available from American Drill Bushing Co., 5107 Pacific Blvd., Los Angeles 58, or Circle No. B9.

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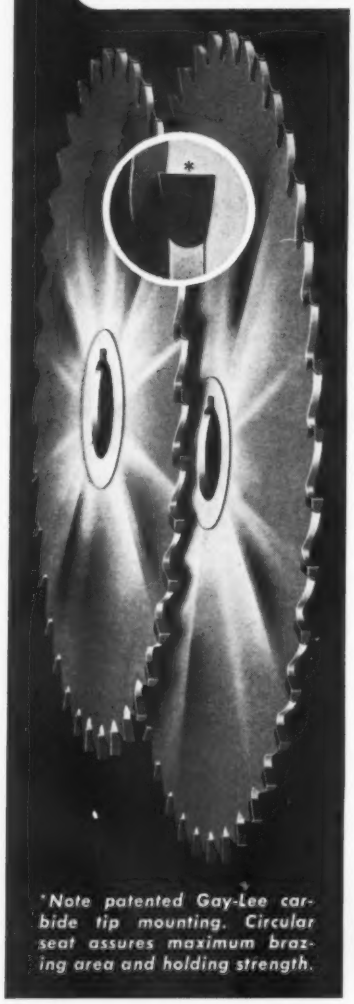
CARBIDE "THINSAWS"



*Note patented Gay-Lee carbide tip mounting. Circular seat assures maximum brazing area and holding strength.

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Gay-Lee Carbide "Thinsaws" maintain positive alignment for full-depth cutting without run-out. "Thinsaw" thickness as low as .030" with tolerance held to .0001". Sizes from 1¼" to 10" O.D.

Patented carbide tip design and circular seat mounting assure maximum brazing area, positive seating and greater holding strength – tips will not break loose.

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The Most significant advance in a quarter Century of HEIGHT GAGE DESIGN
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TOP VIEW
TRIANGULAR SCALE BEAM for Superior Strength and Rigidity, preventing sway and vibration.
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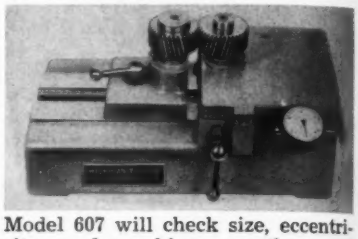
Q-C and Inspection

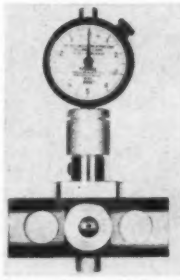
PRODUCTS & PROCESSES & PRODUCTS

A Precision Inspection Equipment bulletin describes and lists specifications for surface plates, lapping plates, universal angle plates, slotted angle plates, and universal right angle irons. Also listed are black granite surface plates from 8" x 12" x 2" to 72" x 144" x 16". Obtain your copy from Monarch Tools, Inc., 2980 Century Blvd., Lynwood, Calif., or Circle No. C1.

A New Low-Cost Gear Rolling Fixture for accurately checking external spur and helical gears has been announced by Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12.

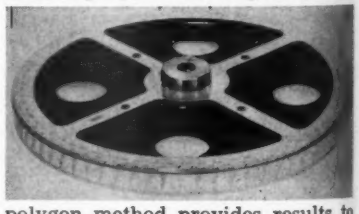


Model 607 will check size, eccentricity, and meshing smoothness of gears up to 10" dia. and registers deflections on an integrated dial indicator in 0.0005" increments. Write to the company for details, or Circle Inform-A-Gram No. C2.



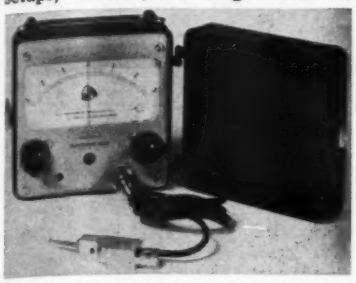
An Amplifier-Indicator for extra close tolerance checks of production and toolroom work, as well as in laboratories, is now offered by Holmes Gage & Development Corp., 537 Bonham Ave., Columbus 3, Ohio. Models with direct dial indicator readings in 0.0002" increments and down to 0.0001" (shown) are available. Get information from the company, or Circle Inform-A-Gram No. C3.

One-Piece Optical Polygons are now available with from 3 to 72 faces for use with optical tooling instruments to set up and test squareness, angles, and circle spacing. This



polygon method provides results to 0.1 sec of arc. For details, write Engis Equipment Co., 431 S. Dearborn St., Chicago 5, or Circle Inform-A-Gram No. C4.

A Transistorized Indicator is simple to operate and easy to set up. Microtrol 170 is suitable for surface plate or height gage work, checking setups, runout, or alignments of

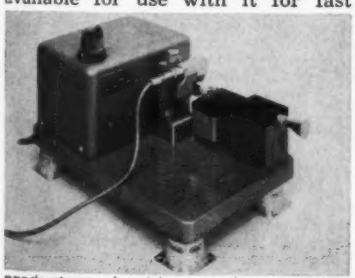


parts and machines, and provides full-scale ranges of 0.0006" and 0.006". Airborne Instruments Laboratory, 160 Old County Rd., Mineola, N. Y., or Circle C5.

"Precision Equipment for The Tool and Machine Industries" is a bulletin which covers over 300 standard precision surface equipment items. Dimensions are given for semi-steel and granite surface

plates, angle plates, bench plates, straight edges, and layout plates. Ask for Catalog 839 from The Challenge Machine Co., Grand Haven, Mich., or Circle C6.

Accurate Measurement of Surface Roughness on all types of balls from 1/16" to 1½" dia is possible with the RJ ball pilotor. Hoppers are available for use with it for fast



production checking, and a variable speed drive also can be installed. Write for information to Micrometrical Mfg. Co., 345 S. Main St., Ann Arbor, Mich., or Circle C7.

Cut MACHINING COSTS 7 WAYS

MAXWELL

UNIVERSAL-POSITIONING

"Throway" Carbide TOOL HOLDER

Ask your mill supply house or Maxwell representative

Also hold square or round tool bits or boring bars with standard clamping cap.

Counterboring

Heavy Turning

Chamfering I. D.

Facing

Chamfering O. D.

1. Adjusts to ANY horizontal position—right, straight, left—in a complete circle. Cuts tool holder inventory!

2. Holds carbide insert to any desired angle or use for facing in either direction—to or from center. The ONLY throwaway carbide tool holder for ANY standard lathe tool post!

3. Precision-ground, positive-rake carbide insert can be indexed FOUR times. Extra savings!

4. Adjustable carbide chipbreaker on cap assembly also can be indexed FOUR times. More economy!

5. Fast, convenient clamping speeds indexing or positioning inserts. Saves time!

6. No need to change tool holder for different work positions. Simply rotate clamping cap and adjust insert. Cuts set-up time!

7. Serrated clamping cap, forged shank and anvil and locking cap screw hold carbide inserts in perfect grip—no lateral movement, no chatter. Cuts scrap loss!

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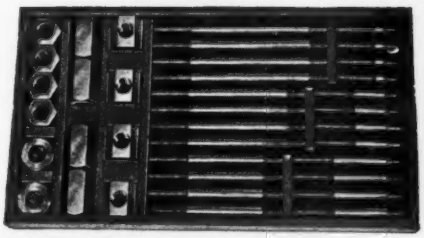
MAXWELL INDUSTRIES, INC.
493 East 5th Avenue • Ashtabula, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 891

REID Tool Room NEEDS

HANDY SET-UP STUD SETS



Available in 12 different sets in wide range of sizes. Each set contains 24 studs, 4 each of T-Nuts, Coupling Nuts, Hexagon Nuts and Washers. Each item also obtainable separately.

FREE—78 page catalog listing scores of needed items for tool room. Address

REID TOOL SUPPLY COMPANY
MUSKEGON HEIGHTS, MICHIGAN

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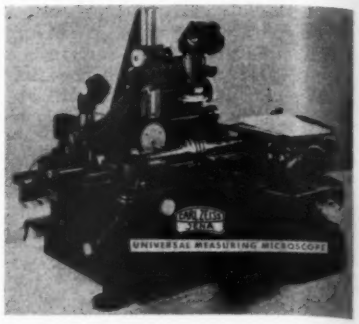
Q-C and Inspection

PRODUCTS & PROCESSES & PRODUCTS

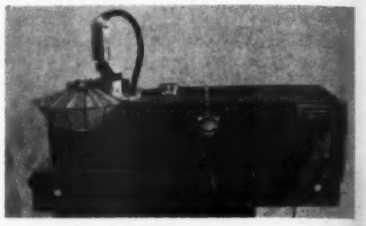
A Wide Total Measurement Range is offered with the Trans-O-Limit gages that feature completely transistorized circuits and four separate magnifications. By flicking a switch, measure thousandths, ten-thousandths, or millionths. Get information from Pratt & Whitney Co., Inc., W. Hartford 1, Conn., or Circle Inform-A-Gram No. C8.

Check Cutting Tools, gages, and thread measurements with this universal measuring microscope, once again available in the U. S. from George Scherr Co., Inc. It also does precision measuring of jigs and fix-



tures with its 4″ x 8″ range. Other Carl Zeiss Jena optical measuring instruments are discussed in a bulletin from George Scheer Co., Inc., 200 Lafayette St., New York 12, or Circle Inform-A-Gram No. C9.

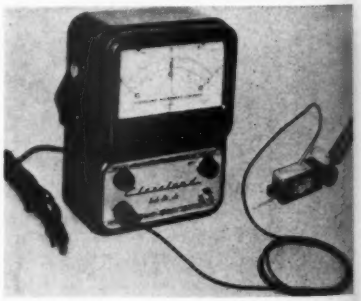
This Germanium Pellet Classifying Machine is an automatic unit for feeding, measuring, and classifying pellets of all sizes. Model LC-13A feeds 3,600 pcs/hr and handles



pellets 0.002″ and up. For additional information, write Electro-Autosizing Machine Corp., Closier, N. J., or Circle No. C10.

A Direct-Reading Internal Diameter Gage and Setting Fixture that requires no masters, rings, or setting blocks, is featured in a bulletin. Operation and application information and dimensions are given in Bulletin SSC-B1 from Sunnen Service Corp., Dept. B-42, 7900 Manchester Ave., St. Louis 17, or Circle Inform-A-Gram No. C11.

A Transistorized Electronic Gage that brings high precision electronic gages into shop areas, has been announced by Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15. Three color coded scales give ex-



treme accuracy in reading the gage and range from less than 0.000020″ to 0.020″. Get details from the company, or Circle C12.

The exclusive automatic Dual Power Feed built into every MARVEL Series 6 and 9 Hack Saw is the "brain" that adjusts and compensates both pressure and depth of feed correctly in proportion to the number of blade teeth in contact with the work. Once the MARVEL Dual Feed is set, no operator attention is required to insure that the blade is cutting as deeply as possible and practical on every stroke . . . regardless of the changing area of the work being cut. Whether the Saw is being used for continuous automatic cut-off of identical pieces or a single cut, the MARVEL Dual Feed that practically "thinks for itself" guarantees that the work is cut-off in the fewest possible number of strokes.

Catalog C35 has complete details, facts and figures on both Marvel metal cutting Hack Saws and Band Saws. Write for it today.

Heavy duty MARVEL Series 6 and 9 Hack Saws embody every practical design and operating feature to give you speed, accuracy and operating economy you can find in no other metal cutting saws.

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ARMSTRONG-BLUM MFG. CO.
5700 BLOOMINGDALE AVE. · CHICAGO 39, ILL.

MARVEL Metal Cutting SAWS
Better Machines—Better Blades

CIRCLE INFORM-A-GRAM KEY NO. 90

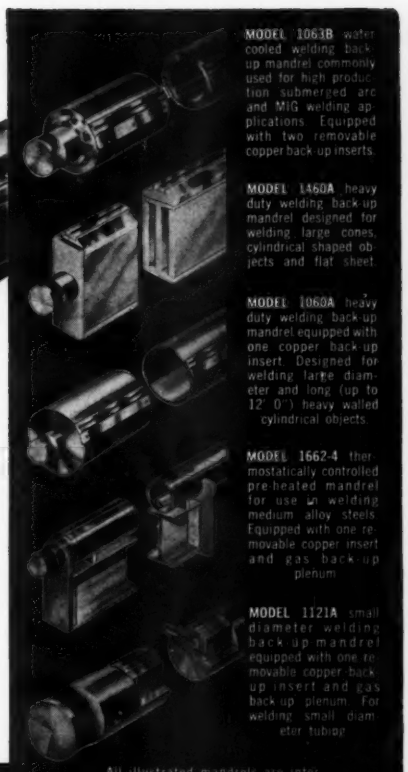
Airline FEATURES A BROAD VARIETY OF
BACK-UP MANDRELS
FOR AIRLINE LONGITUDINAL WELDING POSITIONERS

MODEL 1064B pre-heated back-up mandrel for use with Airline Model LW 10,000 Series Longitudinal Welding Positioner. Equipped with four "quick-clamp" back-up bar receiving grooves 90° apart. One heating oil inlet and outlet. Each back-up insert receiving groove is equipped with gas back-up plenum.

Mandrels are available for welding foils of .003" up to sheet stock of .250". Mandrels are furnished for welding ferrous, non-ferrous, austenitic and ferritic metals. Various models are designed to facilitate positioning of tubular, flat or rectangular shapes and are rotatable and interchangeable. Copper, steel or stainless steel back-up bars are furnished with weld "drop-thru" grooves to control weld root bead, size and contour. Many models are furnished for inert gas backing, featuring a plenum gas reservoir. Inserts are provided with orifices for uniform gas distribution along the weld. Many of these models are designed for normal "chill-shunt" weld tooling principles while others employ thermostatically controlled heating or water cooling.

Stainless steel and steel back-up inserts are for use in welding non-ferrous materials such as aluminum and magnesium alloys. Copper back-up inserts are used for welding steel, stainless steel, titanium, tantalum, molybdenum, zirconium, beryllium-copper, etc.

Write for complete information on Airline Longitudinal Welding Positioners and accessory equipment.



MODEL 1063B water cooled welding back-up mandrel commonly used for high production submerged arc and MIG welding applications. Equipped with two removable copper back-up inserts.

MODEL 1460A heavy duty welding back-up mandrel designed for welding large cones, cylindrical shaped objects and flat sheet.

MODEL 1060A heavy duty welding back-up mandrel equipped with one copper back-up insert. Designed for welding large diameter and long (up to 12'-0") heavy walled cylindrical objects.

MODEL 1662-4 thermostatically controlled pre-heated mandrel for use in welding medium alloy steels. Equipped with one removable copper insert and gas back-up plenum.

MODEL 1121A small diameter welding back-up mandrel equipped with one removable copper back-up insert and gas back-up plenum. For welding small diameter tubing.

All illustrated mandrels are interchangeable in all Airline Longitudinal Welding Positioners

Airline WELDING AND ENGINEERING
760 NORTH PRAIRIE AVENUE, HAWTHORNE, CALIFORNIA

CIRCLE INFORM-A-GRAM KEY NO. 911

SPELLMACO SPOTTERS

A matched set of transfer punches for toolmakers, machinists and tool cribs.

Used for transferring location of threaded, drilled and reamed holes, slugs, blanks, etc.

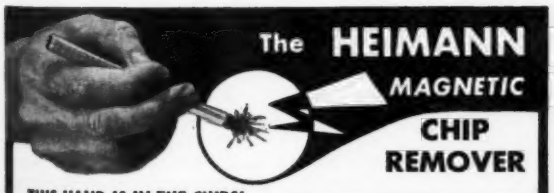
Precision made of finest tool steel carefully heat treated and tempered for long life. .0025 undersize to facilitate use—black oxide finish.

Set No. 3-17: 28 punches with indexed stand—sizes 3/32" to ½" by 1/64" plus hand 17/32" size—length 4⅞". PRICE only $17.90

Single size available.

R. L. SPELLMAN CO. • Urbana, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 912



The HEIMANN MAGNETIC CHIP REMOVER

THIS HAND IS IN THE CHIPS! Yes, and the chips are not in your eyes or hair or ways of machines. The Heimann Magnetic Chip Remover gets chips out of blind holes rapidly, cleanly, safely. It's a lastingly efficient permanent magnet in a knurled aluminum holder. Send it in after chips and it comes out covered with them.

YOU CAN'T AFFORD to be without it! A natural for your tool box or crib. Made ⅛" to ½" sizes, at a price to attract. Write now for circular.

Permanent — Easier
Strong — Convenient
Quicker — Better

HEIMANN MFG. CO., URBANA, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 913

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CIRCLE INFORM-A-GRAM KEY NO. 914

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1436 East 47th St., Cleveland, Ohio. Founded in 1908. Builders of Special Machinery. General Machine Work.

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To Your Specifications
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— Except Screw Machine Cams —
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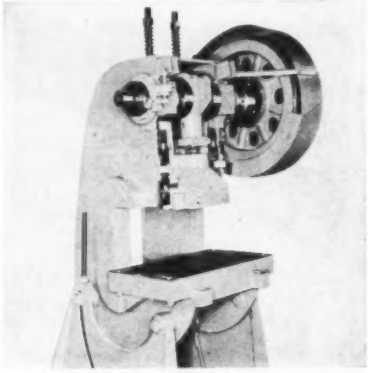
CIRCLE INFORM-A-GRAM KEY NO. 921

Pressworking

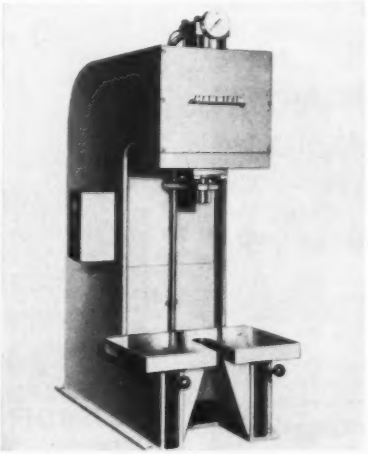
PRODUCTS & PROCESSES & PRODUCTS & PROCESSES & PRODUCTS & PROCESSES & PRODUCTS

Large or Bulky Die Sets for die cast trimming or electronic work that usually require a larger press, now can be accommodated on the new 40-ton Press-Rite OBI press. The heavily reinforced steel fabricated frame provides large ram and bed area and extra depth of throat. Get information from Sales Service Mfg. Co., 2363 University Ave., St. Paul 14, Minn., or Circle Inform-A-Gram No. D1.



Increase the Range of Punching, blanking, forming stamping, and drawing operations using the Kenco Model 2R deep throat punch press. It features 7" throat depth, 6½" x 9" bolster area, and large die space. Other specifications are given in a bulletin from Kenco Mfg. Co., 5211 Telegraph Rd., Los Angeles 22, or Cricle Inform-A-Gram No. D2.

Hydraulic Presses and Preformers for thermoplastic molding are discussed in a bulletin which gives floor and installation dimensions for performer models. Specifications are listed and the hydraulic performing cycle is discussed and illustrated. Get your copy of the catalog from Logan Hydraulics, Inc., 4901 W. Lawrence Ave., Chicago 30, or Circle D3.



For High-Speed Short-Stroke Blanking Operations, use these new non-geared presses with flywheel mounted on the end of the crankshaft. A bulletin discusses these presses and gives general overall dimensions and a press bed plan. Alpha Press & Machine, Inc., 9281 Freeland Ave., Detroit 28, issues Catalog 855P, or Circle D4.

Extra Rugged Construction is featured on the expanded line of redesigned Niagara straight-side single- and double-crank presses. Built in ranges of 50- to 500-ton capacities, the line is available in non-geared, single-geared, and double-geared models, with either single- or twin-end drives. Niagara Machine and Tools Works, 683 Northland Ave., Buffalo 11, N. Y., supplies copies of Bulletin 64, or Circle D5.

Strip Stock Stands and strip and sheet stock oilers, used to handle and lubricate stock being fed to forming or stamping machines, are outlined in a bulletin. Three oiler models automatically lubricate both sides of the stock and handle up to 72" stock width. Details are found in this bulletin from Stamping Specialty Co., Inc., 2141 N. Sherman Dr., Indianapolis 18, Ind., or Circle D6.

Twenty-Two Models make up the newly designed line of open back inclinable presses announced by The Federal Press Co., Division St., Elkhart, Ind. A catalog lists specifications of the models in chart form and also describes accessories. Obtain Catalog 1014-11-58 from the company, or Circle D7.

These New 6-Ton and 8-Ton High Speed Hydraulic Bench Presses are ideal for forming, trimming, and force-fit assembly operations. Tonnage is adjustable from 10% of capacity to full rated capacity, and they can be supplied with index table for automatic operation. Get information from Hannifin Co., Dept. 164, Des Plaines, Ill., or Circle Inform-A-Gram No. D8.

←

It pays and pays and pays...

to use L&S SAWS & KNIVES CUSTOM MATCHED TO YOUR PARTICULAR APPLICATIONS!

A large mid-west manufacturer of decorative laminates reports 400% longer life between grinds with L&S customized carbide-tipped saws.

SOLD ON TERMS THAT GUARANTEE COMPLETE SATISFACTION

90% or more of our carbide knives and carbide-tipped saws are custom built from materials of selected hardness to specific production requirements. As a result, they invariably far out-perform other saws and knives in the carbide category both in cutting efficiency and reduction of downtime and number of grindings required. Savings over conventional steel knives and saws are almost unbelievably large. By all means write for our catalog before buying any carbide tipped saws or solid carbide knives for planers, shapers, molders, or any other application.

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We Repair All Types and Makes of Carbide-Tipped Saws . . . 24-Hour Service

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Punches and Dies

...for foot and power presses

Standard Punches and Dies of all sizes and shapes in stock—or made promptly to order. Also Adaptors and Die Shoes to convert your press. For power, foot or hand operation.

Round, square, rectangular, slotting, notching, louver, angle, multiple, knock-out and other shapes. Precision made from high grade tool steel. More than 25,000 sets in stock to choose from.

27 *years of serving your punch and die requirements*

SEND FOR FREE CATALOG No. 157 AF, illustrating our standard punches and dies and complete line of modern sheet metal fabricating equipment. **NET PRICES SHOWN.**

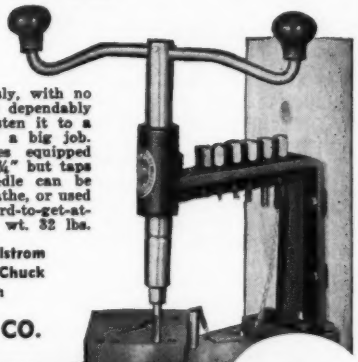
WARD Machinery Co. 564 West Washington **Chicago 6**

CIRCLE INFORM-A-GRAM KEY NO. 933

The Quick, Easy, Handy Way to TAP BY HAND

. . . Adapts for LATHE USE

THE DAHLSTROM TAP GUIDE virtually eliminates tap breakage—and saves those costly hours spent prying broken taps out of dies. Anyone can use it. Just a few turns of the spindle and the job is done.



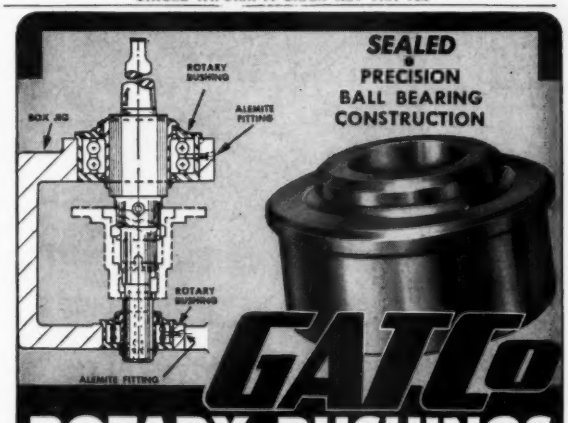
Winds through continuously, with no backoff. Work is always dependably straight and square. Fasten it to a post or set it on top of a big job. This handy tapper comes equipped with 9 adapters, 8-32 to ¾" but taps are not furnished. Spindle can be pulled out and used in a lathe, or used as tap extension for hard-to-get-at-places. 13" x 8" x 14", wt. 32 lbs.

Also Makers of Dahlstrom Autostrop and Tap Chuck
Send for bulletin

BRANCH MFG. CO.
16 Olson Drive
NORTH BRANCH, MINN.

Dahlstrom **TAP GUIDE** — $59.50 F.O.B. Factory

CIRCLE INFORM-A-GRAM KEY NO. 932



GATCO ROTARY BUSHINGS

For DRILLING, CORE DRILLING, ROUGH and FINISHED DRILLING

The inner race of the GATCO bushing rotates with the tool, piloting the tool accurately below or above the work — or both

Eliminates expensive tool construction — Reduces tool wear — Prevents seizure and pilot breakage — Especially adapted where precision is required.

Write for full information and prices

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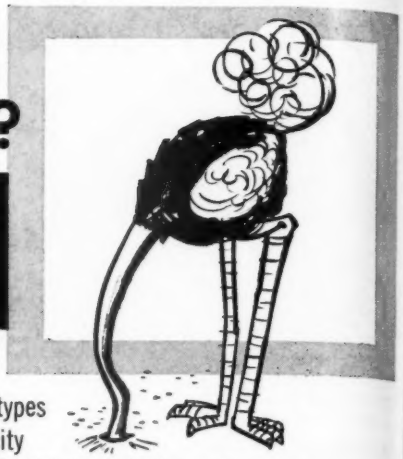
CIRCLE INFORM-A-GRAM KEY NO. 934

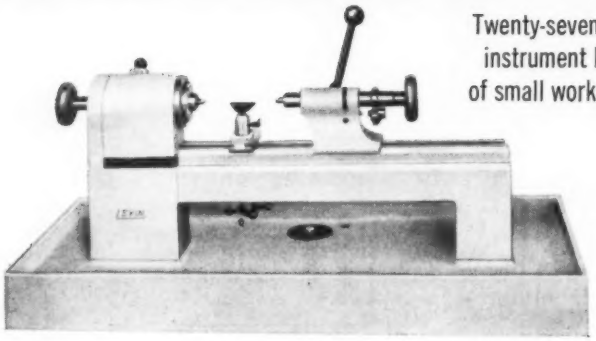
ARE YOU PROPERLY GEARED FOR

MINIATURIZATION?

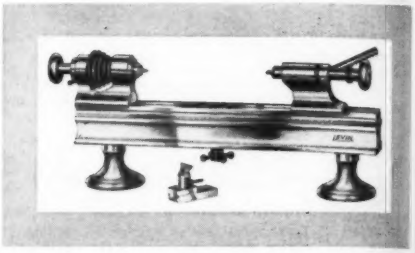
LEVIN® INSTRUMENT LATHES

PRODUCE SMALL INSTRUMENT PARTS BETTER





Twenty-seven models of instrument lathes for all types of small work. Collet capacity 5/16" or 3/16". Levin Instrument Lathes are used wherever fine work is being done. Over 11,000 lathes in use.



For complete details of Levin Instrument Lathes and accessories send for catalog T.

Louis Levin & Son, Inc., 3610 So. Broadway, Los Angeles 7, Calif.

CIRCLE INFORM-A-GRAM KEY NO. 941

SPECIALIST

dead true at the center!

—in draw-in COLLETS

Made in standard and special styles for all lathes, grinders, millers, and fixtures. Fractional round sizes and decimal equivalents from 1/64" to capacity; square, hexagon and taper holes. Checked 25 times against master gauges. Transparent packaging for easy identification.

Stocked in standard styles for immediate delivery.

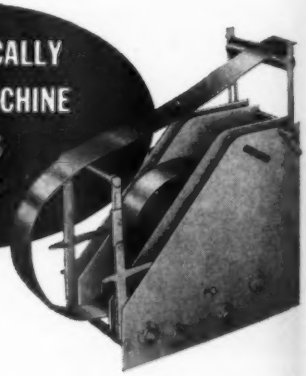
Get free Bulletin 100 E showing standard draw-in collets and step chucks

RIVETT

RIVETT LATHE & GRINDER, INC., Department CTP-2, Brighton 35, Boston, Mass.

CIRCLE INFORM-A-GRAM KEY NO. 942

AUTOMATICALLY FEED ANY MACHINE FROM THIS SLACK LOOP



for greater accuracy and production!

Koil Kradles form a slack loop between coil and machine from which any automatic feed can freely draw! The slack loop eliminates drag and resistance of pulling against heavy coils. Reduced drag improves accuracy of any feed device . . . records show up to 80% more footage handled per shift!

Koil Kradle's variable timer delays shut-off up to 10 seconds after motor switch trips off . . . forms a new slack loop before stopping, eliminates many unnecessary motor starts and stops! Adjustable plates center various coil widths; reversible motor for rewinding; power driven rolls; anti-friction bearings and numerous other features!

ASK FOR CIRCULARS, sizes and prices. Stock widths up to 50", coil weights to 20,000 lbs.

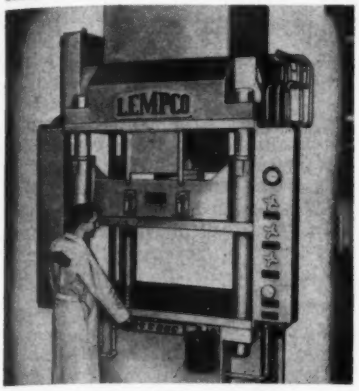
benchmaster

World's largest manufacturer of small punch presses and mills.

1835 W. Rosecrans Avenue • Gardena, California

CIRCLE INFORM-A-GRAM KEY NO. 943

For Metal Forming and Drawing, plastics molding, and die try-out work, use one of the rugged new Series 700 platen presses. Tonnages range from 25 to 600, and sizes from 18" x 12" to 72" x 60".



Simple, convenient controls make them easy to operate. Machine & Tool Div'n, Lempco Industrial, Inc., Bedford, Ohio, or Circle Inform-A-Gram No. D9.

General Bending Theory and Practice Data is given in a bulletin that also describes the line of compression process production bending machines and accessories made by Pendrick Tool & Machine Co., 3638-40 N. Lawrence St., Philadelphia 40. Included are modulus tables for pipes, tubes, and rectangulars, for use in selecting the right machine. Bulletin 58 is supplied by the company, or Circle No. D10.

The New Series of six power-operated rollers have a cam-actuated idler roll and magnetic brake to prevent overcoasting. This feature on the Di-Acro power roller provides a positive stop, enabling the operator

to work to a scribed or hair line without compensating for the rolls coasting. They're available in models from 12" to 42" forming widths from O'Neil-Irwin Mfg. Co., 626 8th Ave., Lake City, Minn., or Circle No. D11.

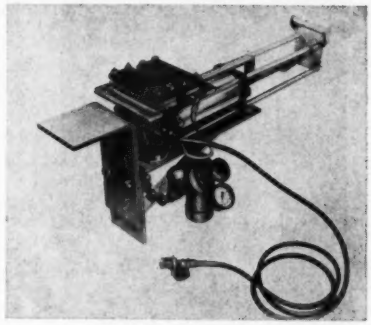
Convert Hand-Fed Punch Press Jobs to safe, faster automatic feeding with this portable air-operated stock feed unit. The Renco-Aire feeder multiplies output and has an exclusive micro-valve which permits feeding both strip and coil stock. Write to Cleveland Pneumatic Industries, Inc., 64 Old Orchard, Skokie, Ill., for details on the four available models, or Circle Inform-A-Gram No. D12.

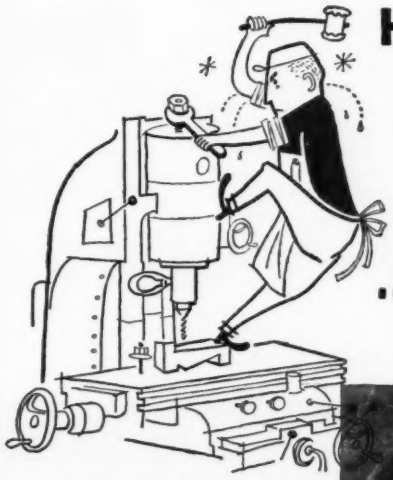
→

The Cumulative Editorial Index is on page 128 in this issue. The Inform - A - Gram Card follows page 68.

Pressworking

PRODUCTS & PROCESSES & PRODUCTS

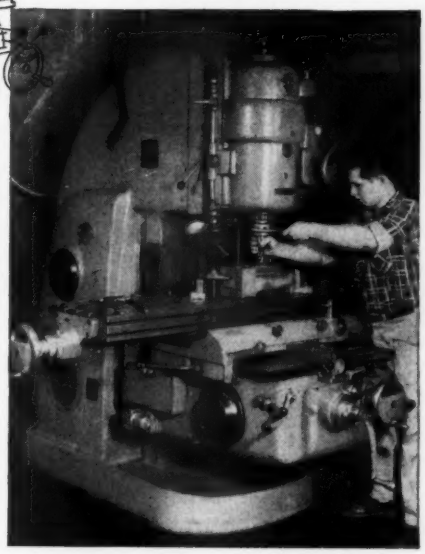




HOW MODERN IS *YOUR* METHOD?

...THIS

... or *THIS*



The modern P.D.Q. tooling method completely eliminates the time lost in changing old fashioned type tools. No more "sweating out" loosening and tightening the draw bolt. A 60° turn of the lock nut and you're ready for another tool. P.D.Q. tool changes are only a matter of *seconds*... and tools are available in very small, small, medium and large series depending on the application. Write for literature covering all the advantages of modern, cost cutting P.D.Q. (Portage Double Quick) tooling.

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PORTAGE Double-Quick TOOL CO.

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Tool performance that increases your production and profits—yet costs you less money . . . it's what you want and what you get —when you use S&E TOOLS

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Prove to your own satisfaction that the performance and stamina you need in tooling today—you get in S&E. A fully illustrated catalog of standard and special tools is available upon request.

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Representatives in all principal cities.

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When a Vise becomes a Virtue...

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4 hardened stepped jaws permit clamping of rough castings, irregularly shaped, round, and tapered pieces accurately and quickly, eliminating need for special jigs or fixtures. Narrow stepped jaws allow free access to and measuring of work pieces and provide clearance for cutting tools. Small work pieces machined on three sides without reclamping. Rigid in any position. Various capacities and extra soft jaws available. — Complete repair facilities available — replacement parts in stock.

Model VD/O

Write also for literature and prices on MBI Reversible Tapping Attachments, Keyless Drill Chucks and Dial Vernier Calipers.

Manufacturers representatives and dealer inquiries invited!

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Assembly

PRODUCTS & PROCESSES & PRODUCTS

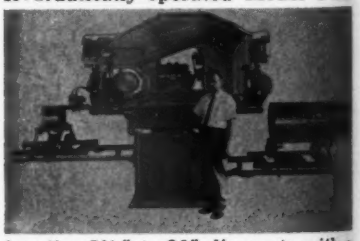
This New One-Piece Reusable Prevailing Torque Locknut accurately preforms the threads in the locking section. When the nut is applied to a bolt, these conforming sectors are elastically returned to a circular pattern and create inward and downward pressure to hold tight. National Machine Products Co., Utica, Mich., or Circle Inform-A-Gram No. E1.

A Line of Vibratory Parts Feeders designed for the automatic, oriented, feeding of small, hard-to-handle parts is presented in a 16-page catalog. It gives details on parts feeder components — bowls and drive units — to be assembled for specific jobs, and specifications of available standard models. Write to Syntron Co., 341 Lexington Ave., Homer City, Pa., for a copy of Catalog 48893, or Circle No. E2.

Properly Tighten Fasteners with this new pre-set snap torque wrench. It features a replaceable standard socket key and is preset to the user's specifications by the manufacturer, so there are no additional

settings to make. Just choose the correct wrench for a specific job. Get details from Skidmore Engineering Co., 5130 Richmond Rd., Bedford Heights, Ohio, or Circle E3.

A Combination Longitudinal-Circumferential Weld-Roller develops up to 25 tons at top pressure of 1,000 psi at the rolls for fast, smooth rolling of butt and lap seam welds. Hydraulically-operated Model 2-LC



handles 5¼" to 36" dia parts with a distance of 2" to 18½" from the edge of the part on the circumference weld. Grotnes Machine Works, 5454 N. Wolcott Ave., Chicago 40, or Circle No. E4.

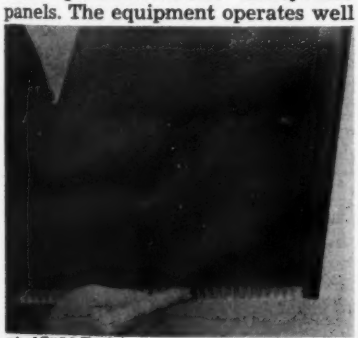
A Weldirectory, that discusses manual electrodes used for hard surfacing and welding stainless steels, non-ferrous metals, and cast iron, is offered by The Lincoln Electric Co., Cleveland 17. It describes each electrode, its properties, and applications. The company supplies copies of Bulletin 7000.2, or Circle Inform-A-Gram No. E5.

An Assembly Tools Catalog has 16 pages of engineering dimensions and specifications for all Waldes Truarc retaining ring pliers, applicators, dispensers, and grooving

tools. Descriptions of assembly fixtures for internal and external rings are included. Get Catalog AT-10-58 from Waldes Kohinoor, Inc., 47-16 Austel Pl., Long Island City 1, N.Y., or Circle No. E6.

Weld High Strength Bronze and Brass with this new low-fuming gas filler rod. It can be used to repair and build up bearing surfaces on steel, cast iron, and malleable iron, and to fix gear teeth, pistons, and cams. Ampco-Braz 4 has high tensile strength, good ductility, and great toughness. Get information from Ampco Metal, Inc., 1745 38th St., Milwaukee 46, or Circle E7.

Vacuum Brazing Equipment is announced by F. J. Stokes Corp., 5500 Tabor Rd., Philadelphia 20, to produce qualification-size honeycomb panels. The equipment operates well



at 1700°F, high enough for honeycomb work, and permits cycles of less than two hrs. Get information from the company, or Circle E8.

Amcor Roller Stock Pushers

FOR POSITIVE STOCK ALIGNMENT

5 IMPORTANT ADVANTAGES

- **LOW COST** — costs only a fraction of hand-made pushers
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- **ANTI-FRICTION** — hardened roller on brass shaft requires minimum effort to insert and feed stock
- **MINIMUM DIE MAINTENANCE**—no refitting necessary when die is sharpened . . . increases pilot life

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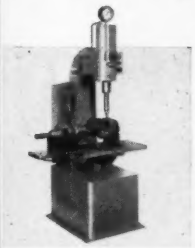
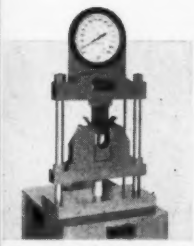
will any of these tests help you?



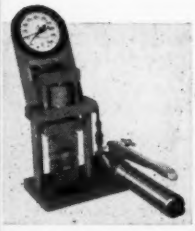
is your problem like this?

Steel City versatile Brinell Hardness Tester checks hardness of automotive crankshafts. One fixture adjustable for four different sizes of shaft. Fixture easily removable to provide standard tester with 12" x 18" opening . . . large table anvil for multitude of testing.



... or more like this?

Steel City Guided Bend Testing Machine makes qualification tests on butt-welded specimens in accordance with AWS and ASME standards. Exclusive design provides automatic ejection of tested part. Unskilled operator makes perfect test.



... or *different* entirely?

Steel City Tensile Tester (hydraulic, hand operated) determines strength of graphite samples. Self-contained unit simplifies tensile testing operation, releases more expensive equipment for other work. Adaptable for powdered metal, other specimens.

Whatever your testing problem

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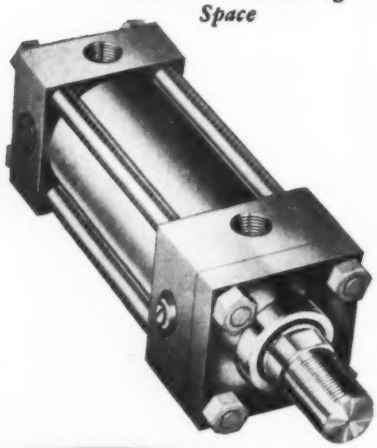

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Pneumatic & Hydraulics

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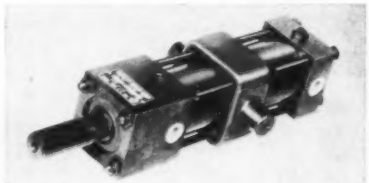
Set Up Any Fast and Slow Feed Combination throughout stroke with the removable cams on new air-hydraulic units by the Electro Mechano Co., 261 E. Erie St., Milwaukee 2.

They're used for automation of milling machines, lathes, drill presses, and assembly operations. They're made in 2" and 3" bore sizes. Write to the company for a bulletin, or Circle Inform-A-Gram No. F1.

A Hydraulic Cylinder is rated to deliver up to 385 tons of thrust at a 5000 psi rating for moderate service operation. The 14" bore cylinder will also deliver 231 tons of thrust at its 3000 psi rating for severe service operation. Get information from Miller Fluid Power Div'n, 2040 N. Hawthorne Ave., Melrose Park, Ill., or Circle Inform-A-Gram No. F2.

Positive Adjustment and a one-piece trunnion are featured on the new line of adjustable heavy-duty air and hydraulic cylinders announced by S-P Mfg. Corp. The design permits use of a full diameter, full

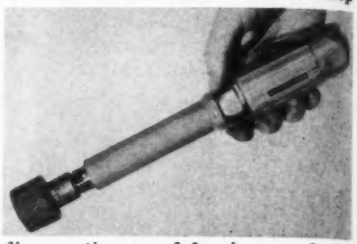


strength cylinder tube, and doesn't employ weakening cuts or grooves in the tube. Get information from S-P Mfg. Corp., 30201 Aurora Rd., Solon, Ohio, or Circle Inform-A-Gram No. F3.

These Compact, Low Cost, General Purpose Air Pressure Regulators (Series 112) have excellent flow capacity and accuracy. Another regulator (Series 113) has a self-relieving feature which prevents pressure build-up in the low pressure system and permits downward pressure adjustment without bleeding the line. Watts Regulator Co., Industrial Div'n, 10 Embankment Rd,. Lawrence, Mass., or Circle Inform-A-Gram No. F4.

Heavy-Duty Air Cylinders are detailed in a bulletin that shows detailed diagrams of Series "A" cylinder models and lists their dimensions in chart form for easy selection. Engineering data is also included. Get your copy of Bulletin A-100 from Milwaukee Cylinder Co., 5757 S. Pennsylvania Ave., Cudahy 7, Wis., or Circle Inform-A-Gram No. F5.

Hard to Reach Spots are now accessible with the new Dotco heavy-duty pneumatic tool with long extension. Model 2EL5 reaches deep



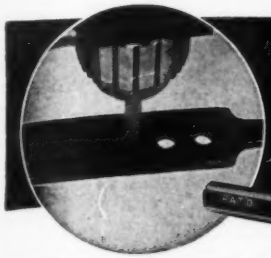
dies, castings, and forgings, and also permits two-handed operation for heavy-duty grinding. Details are available from Doeden Tool Corp., Sherwood, Ohio, or Circle Inform-A-Gram No. F6.

A New Line of One-Spool Hydraulic Directional Control Valves with handles is for general-purpose applications. Three capacities are offered with nominal ratings of 12, 20, and 40 gal/min and recommended maximum working of 2,000 psi. They feature exceptionally low pressure drop and superior metering. Get Bulletin 1552A19 from Parker Hydraulics Div'n, Parker-Hannifin Corp., 17325 Euclid Ave., Cleveland 12, or Circle Inform-A-Gram No. F7.

A Newly-Designed Speed Control Valve can be installed as an integral part of any Hannifin Series CC directional air control valve. This speed control section accurately controls cylinder piston speeds by independently metering exhaust flow from both ends of an air cylinder through a single exhaust port in the valve. Hannifin Co., Dept. 164, Des Plaines, Ill., or Circle No. F8.

"Fulflo Filters for Compressed Air and Other Gasses" is the title of a bulletin which presents technical information and charts on flow characteristics, physical dimensions, and metals of which the filters are made. Write to Commercial Filters Corp., 2 Main St., Melrose, Mass., for your copy of Bulletin GEO-507, or Circle Inform-A-Gram No. F9.

Drill Hardened Steels without Annealing—



USE The New IMPROVED "HARDSTEEL" DRILL

With the new, improved "HARDSTEEL" Drill, you can do accurate, smooth drilling, countersinking, counterboring and reaming in steels hardened by any process without first annealing the work. And they work with equal ease on work-hardening steels and high carbon—high chrome steels of any degree of hardness.

"HARDSTEEL" Drills fit standard drill presses. They save time and reduce rejects. They permit engineering changes requiring additional drilling after hardening. And parts drilled after hardening always match at assembly.

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complete protection against dirt, grime and wear for any moving part with

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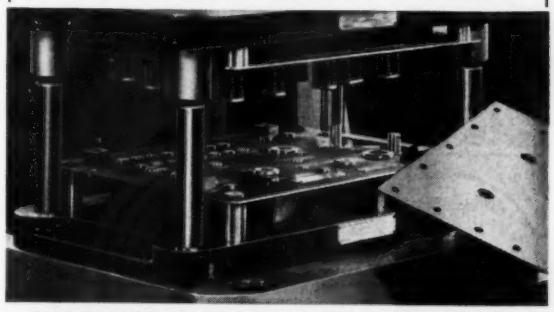

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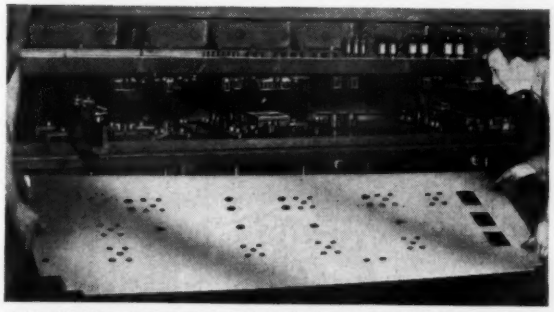
All parts reusable and interchangeable. Punches and dies stocked in .001" increments from .100" thru .500" dia. Larger sizes available.



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Pneumatics & Hydraulics

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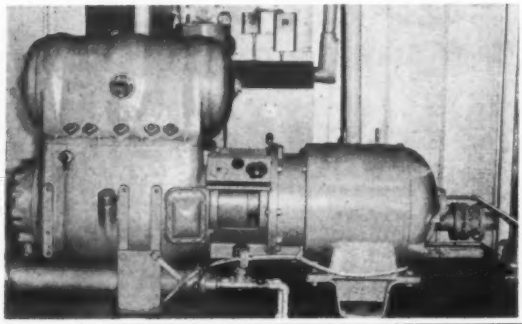

An Improved Industrial Rotary Air Compressor Line features new Perma-Vane rotor blades for greater wear resistance. Light weight and minimum friction reduces amount of horsepower required by the compressor for more economy. The Hydrovane rotaries are available in 2 to 125 hp sizes. Davey Compressor Co., Kent, Ohio, or Circle Inform-A-Gram No. F10.

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The names of these nationally known organizations are available on request.

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For prices, ordering information, full details. . . . .

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9 Valley Street, Wakefield, Mass.

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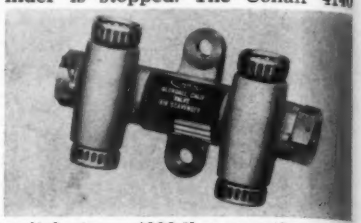
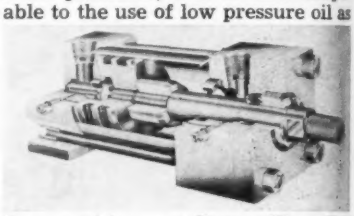
This New Air Scavenger Valve removes air by permitting flow from the pressurized line to the non-pressurized line when the Servo cylinder is stopped. The Conair 4140



unit features 4000 lbs operating pressure, 325°F operating temperature, and less than ½ lb weight. Conair, Inc., 731 W. Wilson, Glendale 3, Calif., or Circle No. F11.

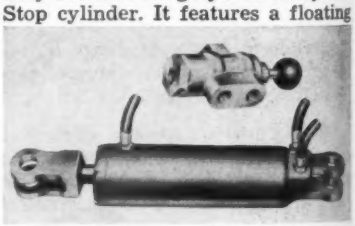
These Diaphragm-Operated Control Valves actuate any 3-way pilot valve, instrument control, cycle controller, or process timer. They are designed for 20 to 60 psi air actuation, 15 psi instrument pressure, and handle intermittent actuation pressures up to 125 psi. Get literature from Valvair Corp., 454 Morgan Ave., Akron, 11, Ohio, or Circle Inform-A-Gram No. F12.

This New Interchangeable Air Cylinder of square head design produces maximum force with minimum pressures, and is also adaptable to the use of low pressure oil as



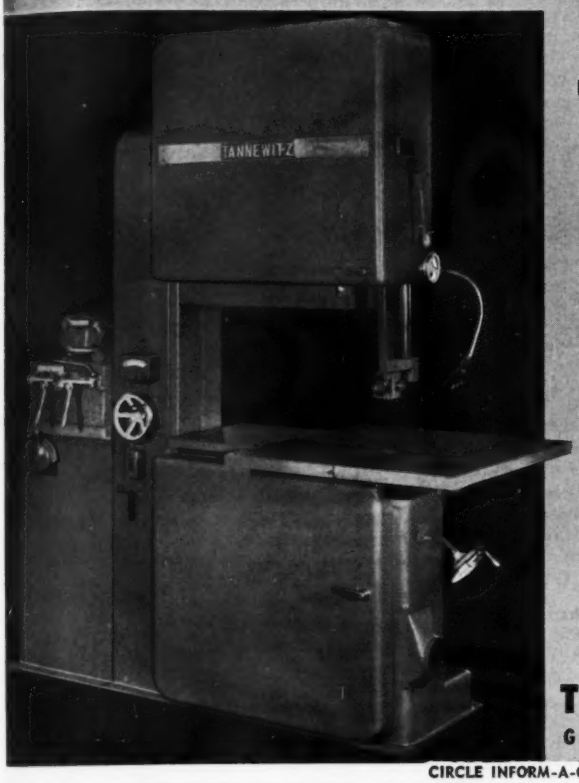
the working medium. The T-J Squair head comes in 1½" to 8" standard bore diameters. Write Tomkins-Johnson Co., Jackson, Mich., for Bulletin SQ-10-58, or Circle Inform-A-Gram No. F13.

Hydraulically Change and Maintain Desired Stroke from a remote station with the Densmore heavy-duty double-acting hydraulic Hydro-Stop cylinder. It features a floating



piston within the cylinder which is controlled by a special valve. Write Desmore Engineering Co., Inc., 2003 E. 14th St., P. O. Box 1557, Oakland 4, Calif., for information, or Circle Inform-A-Gram No. F14.

Any speed from 50 to 11,000 fpm with this Vastly Superior NEW BAND SAW by TANNEWITZ



Ideal for tool room sawing, trimming castings or friction sawing steel and other metals formed or flat . . . the most versatile, efficient and best built machine in the field. Note these new features:

1. **HEAVIER CONSTRUCTION** than any machine of its type — solid as a rock.
2. **MAXIMUM CAPACITY** . . . unobstructed from blade to column — 6" greater vertical clearance.
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5. **GRINDER AND WELDER** right where it is needed.
6. **AUTOMATIC HYDRAULIC AUTOMOBILE BRAKES ON ALL MODELS.**

These and dozens of other features that make it the greatest time and money saving metal cutting machine on the market. Write or phone for complete details.

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- HEAT TREATED
- DELIVERY FAST
- COST LESS!

CARR-LANE JIG AND FIXTURE COMPONENTS ARE BETTER IN EVERY WAY YET COST LESS THAN THEY COULD BE PRODUCED IN YOUR OWN SHOP!

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Carr Lane MANUFACTURING COMPANY
4202 KRAUSE COURT
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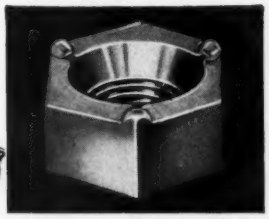
CIRCLE INFORM-A-GRAM KEY NO. 1012

These 2 WELD NUTS for blind assemblies will give you

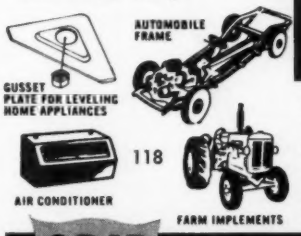
- Easier Positioning
- Quicker Fastening
- Extra Threaded Depth
- Less Cost

Available with or without Gripco locking feature. Three weld projections on bottom of nut provide a firm non-rocking electrical connection during welding. Write for samples and NEW CATALOG today.

Gripco Pilot-Projection Weld Nut, circular pilot designed, provides quick, easy positioning of nut in bolt hole for instant resistant welding. No jigs, no fumbling, no waste of time. Weld spatter cannot foul threads. Two pilot heights for different metal gauges.



Gripco Countersunk Weld Nut eliminates time-wasting retapping of nuts after welding. Exclusive countersunk nut bottom eliminates fouling of threads by weld spatter. No time wasting false starts, no cleaning of damaged threads, nut ready to receive bolt immediately.



GRIP NUT COMPANY
107 Maple Ave. • South Whitley, Ind.

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Long length drills for general purpose drilling!

ACE

TAPER LENGTH DRILLS

Feature for feature, you can't beat Ace Taper Length Drills. First, because they're made of the finest quality high speed steel properly heat treated to assure the ultimate in uniform hardness. Second, because they're produced by the Ace-originated "ground-from-the-solid" process to give them smoother, more highly polished flutes with keener, stronger cutting edges. And finally, because they cut faster, last longer, give you more production per drill at lower cost.

Call your local Ace Drill Distributor today!

NEW CATALOG covers the entire line of Ace "Ground-from-the-Solid" High Speed Steel and Carbide Drills, Reamers, Drill Blanks and Special Drills. Send for it today!

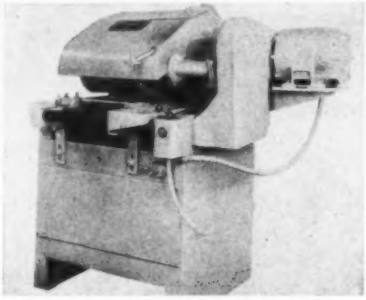
ACE DRILL
ADRIAN, MICHIGAN

ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS
CIRCLE INFORM-A-GRAM KEY NO. 1021

Grinding & Finishing

PRODUCTS & PROCESSES & PRODUCTS & PROCESSES & PRODUCTS & PROCESSES & PRODUCTS

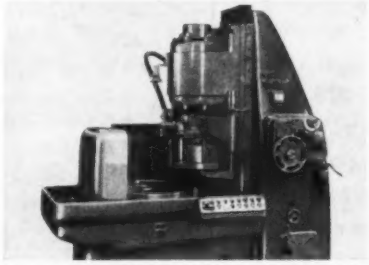
For Finishing, Sanding, and Polishing Operations now being done by hand, use the Timesaver Speedbelt 12" abrasive belt machine. It's used in tandem and in production lines where small metal parts are



directly fed by conveyor for deburring, polishing, or finishing. Three types of feed tables are available for it from Timesaver Sanders, P. O. Box 7446 Robbinsdale Station, Minneapolis 22, Minn., or Circle Inform-A-Gram No. G1.

"The Lorco Vibrator ... a New Concept of Precision Finishing" tells about a new method of precision finishing that works from 10 to 100 times faster than tumbling barrels. Other advantages and specifications are given along with illustrations of typical applications. Get Bulletin 258 from Lord Chemical Corp., 2068 S. Queen St., York, Pa., or Circle Inform-A-Gram No. G2.

A Quick-Tilting Device for creating wheel clearance on vertical-spindle rotary surface grinders makes possible conversion from rough to finish grinding in seconds. Just a



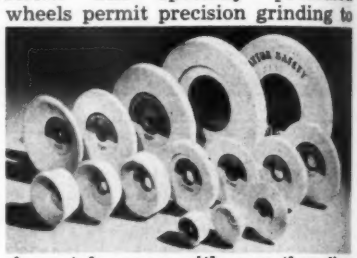
turn of a switch tilts the table to eliminate time-consuming adjustments. Mattison Machine Works, Rockford, Ill., or Circle Inform-A-Gram No. G3.

"Coated Abrasive Grinding Machines" is the title of a 17-page bulletin which contains specifications, descriptions, and advantages of a number of different grinding machine models. Single and double belt grinders and several sizes of disc grinders are included. Write to Rankin Brothers Mfg., Inc., 11090 S. Alameda St., Lynwood, Calif., for this bulletin, or Circle Inform-A-Gram No. G4.

A New Sealed Quill is ideal for grinding with diamond wheels or for work performed with coolant and cutting fluids. The Dumore 12x-350 can be used on the Series 12 grinder or it also makes an ideal quill for special workheads mounted on the grinder or by itself held in a special fixture. The Dumore Co., Racine, Wis., or Circle Inform-A-Gram No. G5.

Rapid, Highly Accurate Production surface grinding of small- and medium-sized work can be done on the new 618 Micromaster surface grinding machine, discussed in a bulletin. Specifications are given for three basic models. Get your copy from Brown & Sharpe Mfg. Co., Machine Tool Div'n, Providence 1, or Circle Inform-A-Gram No. G6.

A Line of V-8 Bonded Grinding Wheels were designed for use with high speed steels and special alloy steels. The specially processed wheels permit precision grinding to



closer tolerances with smoother finishes and no chatter marks. Simonds-Worden-White Co., 1101 Negley Pl., Dayton 7, Ohio, or Circle Inform-A-Gram No. G7.

A New Finishing Unit, designed for a multiplicity of parts, handles paired components which must be deburred yet remain together, such as connecting rods and caps. Model MM-4-8 has a 1-min time cycle and

produces 480 pcs/hr. Parts are mounted on air-operated spindle fixtures and rotated while submerged in a fluid abrasive mass. Mecha Finish Corp., Sturgis, Mich., or Circle Inform-A-Gram No. G8.

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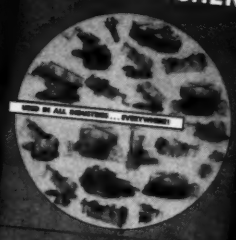
ON WORK HOLDING TOOLS FOR PRODUCTION, TOOLING, MAINTENANCE

PALMGREN



Drill press vises, angle vises, swivel machine vises, rotary tables, lathe milling attachments, production vises, heavy duty angle vises, and adjustable angle plates are illustrated and fully described in the New Palmgren Catalog. This is the only complete line of work holding devices available anywhere. Designed for production, tooling, and maintenance work, there are 68 different models and types to choose from. Vise jaw sizes are from 1½" to 8". Ask for your copy of this FREE Catalog No. 205 today. The complete line with details and prices are shown.

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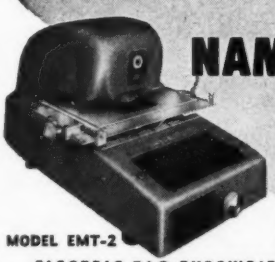
MARK NAME PLATES 5 TIMES FASTER



MODEL EMT-2

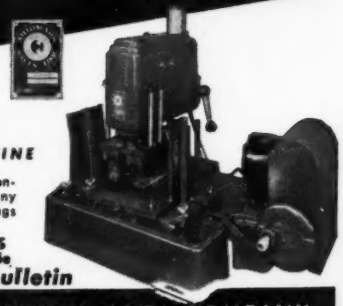
ELECTRIC TAG TYPEWRITER

A touch of the finger delivers up to 2 tons pressure for deep, legible impressions in metal or plastic tags.

—WITH—

Automark

ELECTRIC TAG MARKING MACHINES



MODEL SRST-2

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TAG MARKING MACHINE

Automatically marks BOTH consecutive and serial numbers at any desired speed up to 8,000 tags per hour!

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THERE IS NO PROUDER NAME IN MACHINE TOOLS . . .

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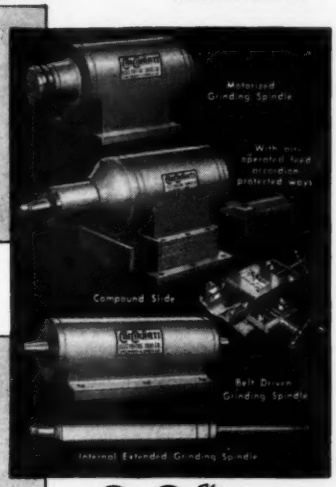
FAMOUS SINCE 1902

. . . NOW on America's New line of Super Precision SPINDLES



GRINDING, BORING, DRILLING, MILLING, ROUTING, WORK HEADS

These are a few of the spindles MADE TO ORDER in recent years by CINCINNATI for tough jobs. These units have top performance records covering months and years of plant use.

We have learned our "trade" by solving manufacturing problems. Our application of a CINCINNATI SPINDLE can solve yours!

We invite your inquiries. Our new Bulletin S-58 is ready NOW, a portfolio of field-tested spindles, slides and feeds for every purpose.

WRITE TODAY!

The CINCINNATI ELECTRICAL TOOL CO.

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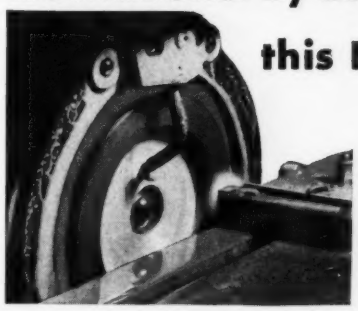

this NEW A.I.T. "E-2" Diamond Wheel for...

ELECTROLYTIC GRINDING

The exclusive "E-2" bond in A.I.T. diamond wheels has been developed specifically to guarantee that you get the FULL VALUE out of Electrolytic grinding of carbides. We can prove this in YOUR plant, on YOUR grinders, with these results:

1. Wheel pre-run to eliminate break-in time in YOUR plant.
2. Faster stock removal.
3. High peak removal for longer intervals
4. Longer wheel life.
5. Less corrosive action
6. Specially designed wheel to reduce weight and distribute electrolyte efficiently

Remember, to get these FULL VALUE results, be sure to send for complete test data today.

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A.I.T. Diamond Tool co.

8217 N. KIMBALL AVE. SKOKIE, ILLINOIS

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AIR-MITE

HIGH PRODUCTION AIR PRESS

with more Quality Features

★ Solid Steel Column. Greater strength and rigidity.

★ Brass cylinder, aluminum end castings, Hy-Car piston cups.

★ Accurately ground table.

★ Fast set-up and stroke adjustment.

You don't have to "baby" an AIR-MITE Press because they're ruggedly built to stand the gaff of production work. From the tip of their solid steel column to the heavy base, they're every inch a workhorse tool. Feature-for-feature, you can't buy a better, more economical operating press than an AIR-MITE.

Special adaptations available. Write us your needs.

1 Ton Capacity

$89.95

F. O. B. Chicago

New 3 Way Control Valve. For safer, more efficient press work, use AIR-MITE Control Valves. Connected in parallel and positioned on either side of an air press, they provide a safe, instantaneous press operating control. Operator must depress both handles to actuate press . . . keeps attention on work-piece, hands out of the way. For pressures up to 160 p.s.i.

AIR-MITE Devices, Inc.

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CIRCLE INFORM-A-GRAM KEY NO. 1041

. . . offers you ***SAFETY*** *and economy of feeding and ejection*

PRES-VAC SAFETY FEEDERS feed blanks to press from a safe distance of 14 inches—BY AIR!—maximum protection to operators and handling costs kept at a minimum.

Save those fingers. $35.00

AIR BLAST VALVES eject parts safely with each stroke of the press—BY AIR!

Save those hands. $29.00

4583

Write for NEW Catalog!

VAC-U-MATION DIVISION

4197 Ravenswood Avenue, Chicago 13, Ill.

District Offices: Detroit and Cleveland

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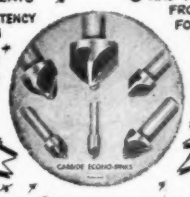
HAVE YOU CHECKED YOUR *COUNTERSINKING COSTS* LATELY?

A *Severance* CARBIDE ECONO-SINK WILL GIVE YOU —

- INCREASED ACCURACY
- MORE PRODUCTION
- LESS DOWN-TIME
- SMOOTHER SEATS
- AND A COMPLIMENT FROM THE BOSS FOR SUGGESTING THE CHANGE
- LONGER CONSISTENCY OF OPERATION

Chatter-Free DESIGN

Solid CARBIDE CUTTING HEADS



MAKE THE Switch to Carbide BEFORE IT'S TOO LATE

WITH THE NEW Severance CARBIDE ECONO-SINK YOU GAIN ALL THE ADVANTAGES OF CARBIDE TOOLING - AND AT LESS COST per Countersunk Hole

Ask for Information & Prices TODAY!

Severance TOOL INDUSTRIES INC.

730 Iowa Avenue — Saginaw, Michigan

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Immediate delivery on OK Bronze Wear Plates Composite Die Sections

SHEAR BLADES

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THE OHIO KNIFE CO.

CINCINNATI 23, OHIO

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Make 3 hammers AT ONCE!

It's the NEW, easy, economical, quick way to mold your own lead hammers on a production basis with "SHUR-GRIP" handles and this COOK production mold.

COMPLETE LEAD HAMMER SERVICE

Write for circular and prices

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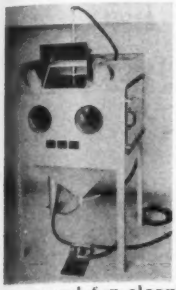
68 MASSASOIT AVENUE, EAST PROVIDENCE 14, R. I.

CIRCLE INFORM-A-GRAM KEY NO. 1045

The Inform-A-Gram card which follows page 68 is for your convenience in making inquiries about advertised Products and Editorial items.

Data on Spray Decorating Equipment includes information on electro-formed nickel and copper masks, mechanical and air-operated clamps and pressure fixtures, automatic mask washers, and an automatic spray decorating machine. Conforming Matrix Corp., 416 Toledo Factories Bldg., Toledo 2, Ohio, will send you a copy upon request, or Circle Inform-A-Gram No. G9.



A Newly-Improved Double-Duty Blasting Cabinet features two independent ceramic-nozzled blast guns. One is vertically mounted and the other is a flexible trigger-operated hand gun used for cleaning small articles, crevices, and angles. For details, contact Cyclone Sandblast Equipment Co., 42 Clara St., San Francisco 7, or Circle G10.

"Barrel Finishing and Wet Blasting Media, Compounds, and Abrasives" is a bulletin which outlines 19 different sizes and shapes, in four different types of substance, of abrasive media. Charts also list chemical compounds and liquid abrasives. Request Bulletin 89 from Techline Div'n, Wheelabrator Corp., 1183 Avenue V, Vicksburg, Mich., or Circle Inform-A-Gram No. G11.

A New Mounted Wheel Bulletin is available from Chicago Wheel and Mfg. Co., 1101 W. Monroe St., Chicago. It illustrates the wheels and lists dimensions and the 200 standard sizes and 86 standard shapes available in a variety of bands, including vitrified, resinoid, and soft rubber. Ask the company for Bulletin 1505, or Circle No. G12.

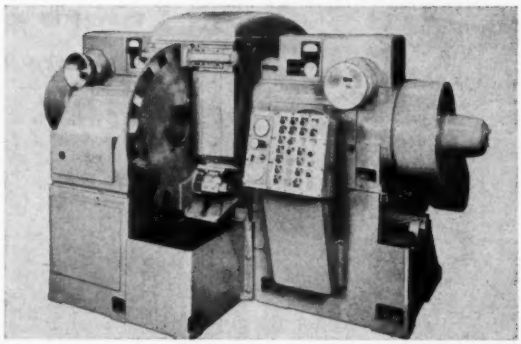
Use These High Speed Powerful Die Grinders in tool an die shops, machine shops, or wherever filing, grinding, cutting, and polishing operations are involved. They come

in two sizes, with rated speeds of either 40,000 or 60,000 rpm, and are suitable for a wide range of wheel sizes. Thomas C. Wilson, Inc., 21-11 44th Ave., Long Island City, N. Y., or Circle Inform-A-Gram No. G13.

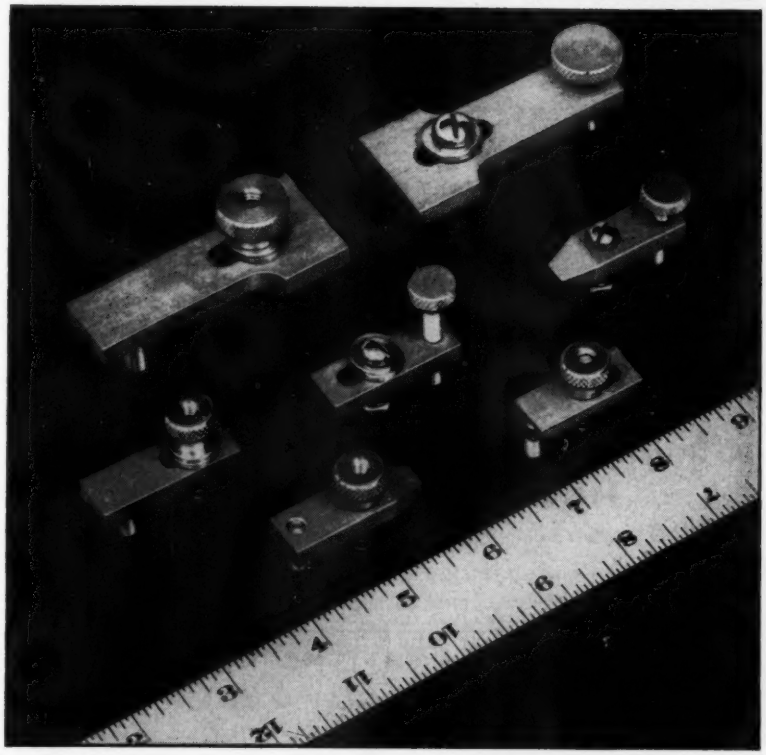
This New Double Horizontal - Spindle Disc Grinder features sealed quill construction, push-button operation, accuracy to tenths, and automatic dressing and sizing. It grinds parts like bearing races, piston rings, and gear blanks, and materials such as steel, cast iron, and carbides. Write for Bulletin DH4, to Besly-Welles Corp., 210 Dearborn Ave., S. Beloit, Ill., or Circle Inform-A-Gram No. G14.

Grinding & Finishing

PRODUCTS & PROCESSES & PRODUCTS



LODDING'S LITTLE FELLOWS



- **Non-magnetic - stainless steel type 303**
- **Tensile strength 90,000 p. s. i.**
- **Heat resistant - austenitic series (not affected by heat treatment with high resistance to scaling and distortion)**
- **Corrosion resistant (high resistance to many corrosives including acids)**

More than 85 details and 30 assemblies available immediately from stock

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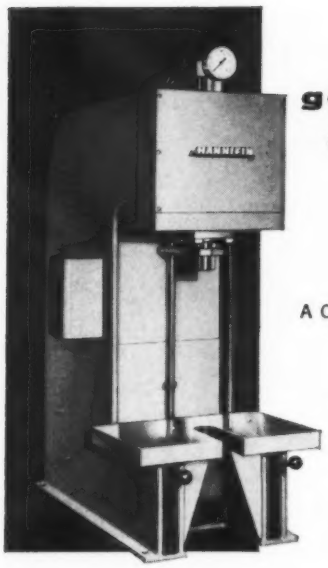

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at lower cost with
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A COMPLETELY NEW LINE OF HIGH-SPEED
HYDRAULIC BENCH PRESSES

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FAST DELIVERY—ALL THESE SIZES!
2, 3, 4, 5, 6, 8, 10 and 12 TONS

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HEAVY-DUTY OPEN-GAP
PRODUCTION PRESSES

Our quantity production gives you highest quality at lowest cost.

THEY HAVE "EVERYTHING"...

Dual Safety Hand Lever Controls
Dual Electric Push-Button Controls
Adjustable Stroke Control
Reverse on Pressure or Distance
Full Automatic Cycling
Hannifin High Speed Hydraulic Index Tables
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USE THEM FOR...

Assembly Operations
Riveting—Staking
Forming—Stamping
Trimming Die Castings
Trimming Plastics
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MAY BE FLOOR MOUNTED—OPTIONAL, LOW-COST BASES AVAILABLE

Call in your nearby Hannifin man—he's a trained production analyst—to prove how you can do more at lower cost with Hannifin presses. Or, write for our new Bulletin 132A. It tells the whole story.

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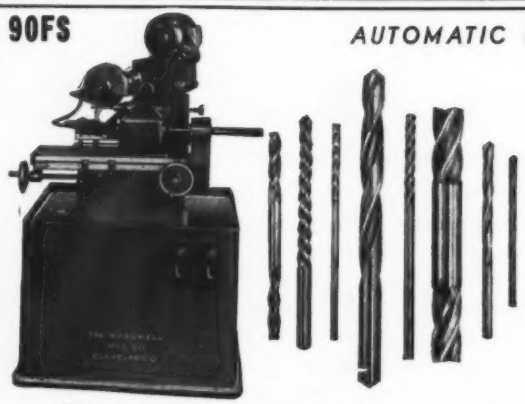
A DIVISION OF PARKER-HANNIFIN CORPORATION

CIRCLE INFORM-A-GRAM KEY NO. 1061

90FS

AUTOMATIC UNIVERSAL

FLUTE
GRINDER



Grinds straight or spiral flutes from solid, including carbides, in tools such as:

Drills as small as 1/16 inch dia. . . .

Spiral or straight taper reamers . . .

Spiral or straight milling cutters and end mills . . . Sharpens saws up to 12 inch in diameter and in gangs up to 7¾" long.

AUTOMATIC INDEX FEED

Write for free Bulletin 90-FS

WARDWELL
Manufacturing Co.
3809 Ridge Road
Cleveland 9, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 1062

Materials

PRODUCTS & PROCESSES & PRODUCTS

A Conversion Chart presents the comparable hardness numbers in three groups. Listed are hardened steel and hard alloys in one section, and soft steel, grey and malleable cast iron and most non-ferrous metal in the other two. Get your chart from Lincoln Gage Co., 23900 Harper Ave., St. Clair Shores, Mich., or Circle Inform-A-Gram No. H1.

"Sagamore-EV Free Machining Air Hardening Die Steel" is a bulletin which tells how the steel is applicable to blanking and forming punches, dies, and rolls, cold or hot trimmer dies, and plastic molding dies. Physical and mechanical data, and forging and annealing information, is included. Get a copy from Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh 22, or Circle Inform-A-Gram No. H2.

A New Wear-Strip Material of aluminum and bronze is available in extrusions or castings. Meier Wearite is ideal for wearplates, slides, and jigs for machine manufacture and machinery maintenance. It has uniform chemical structure and fine wear characteristics. A brochure is available from Meier Brass & Aluminum Co., 1471 E. 9 Mile Rd., Hazel Park, Mich., or Circle Inform-A-Gram No. H3.

Reduce Damage while breaking in new machinery with the new Molykote molybdenum disulfide "wear-in" compound. The compound shortens the "wear-in" period without use of abrasives, reduces the galling, seizing, and excessive wear during this period, and doesn't need to be burnished into the surface for maximum effect. Get details from The Alpha-Molykote Corp., Stamford, Conn., or Circle Inform-A-Gram No. H4.

"Precision Annealed Phosphor Bronze" is a booklet which describes and pictures the effects of the precision annealing technique on spring temper phosphor bronze sheet and strip. Advantages and comparisons of the material are included. Obtain this catalog from Waterbury Rolling Mills, Inc., Waterbury, Conn., or Circle Inform-A-Gram No. H5.

A Heat Resistant Alloy that offers an exceptional combination of strength and resistance to carburization, oxidation, and thermal shock, is outlined in a bulletin. Chemical composition, stress rupture properties, and short time high temperature properties are given for Alloy Ra-330. Get Bulletin 107 from Rolled Alloys, Inc., 5309 Concord, Detroit 11, or Circle No. H6.

Steel and Aluminum Data is presented in a 256-page book that includes aluminum analyses, characteristics, mechanical properties, and tolerances. Data on steel machining and fabricating, manufacturing practices, and tolerances is also given. Request this data book from Joseph T. Ryerson & Son., Inc., Box 8000-A, Chicago 80, or Circle Inform-A-Gram No. H7.

A New Grade of Cold Finished Bars with the addition of lead for superior machinability is offered by Jones & Laughlin Steel Corp., 3 Gateway Center, Pittsburgh 30. Features of Jalcase 100-L include high level of wear-resisting hardness, minimum yield strengths of 105,000 and 10,000 lbs/sq in, depending on bar diameters. For details, write the company, or Circle Inform-A-Gram No. H8.

Fabrication of Hastelloy Alloys describes techniques for welding, forming, and finishing these alloys. A chart is included which gives data on cutting speeds, and type of tools and coolants to be used in machining the different alloys. Haynes Stellite Co., Div'n of Union Carbide Corp., Kokomo, Ind., supplies copies, or Circle No. H9.

Save Time Selecting Thermostat-Metal Element Size and properties for new applications using the bulletin, "Graphical Determination of Element Size and Performance," from Metals & Controls Corp., General Plate Div'n, Attleboro, Mass., Over 40 different Truflex Thermostat metals are listed in Bulletin TRU-8, available from the company, or Circle Inform-A-Gram No. H10.

"Engineering Properties and Applications of Ni-Resist" is a 64-page catalog which explains advantages of these high nickel alloy cast irons. Detailed charts list corrosion data, mechanical properties, and composition range. Illustrations accompany application data. Get this catalog from The International Nichel Co., Inc., 67 Wall St., New York 5, or Circle Inform-A-Gram No. H11.

Improved Free-Machining Stressproof Steel Bars are reviewed in a bulletin that explains the benefits resulting from these improvements in strength, machinability, and tolerances. Other features and property analysis are given. Get a copy from La Salle Steel Co., P. O. Box 6800-A, Chicago 80, or Circle H12.

A New Materials Price List discusses a new quantity discount program announced by Almco-Queen Products Div'n, King-Seeley Corp., Albert Lea, Minn. Specifications are also given for descaling, grinding, and burnishing compounds, and media including bonded, oxide and ceramic chips. Get your copy from the company, or Circle No. H13.

Cast Stellite Cuts Costs with SHAW PROCESS

These forming dies and mandrels for jet engine hollow vanes were CAST complete with thermal holes.

Untold hours of machining of this tough material were saved by our customer.

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JIG BORING
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Done to your specifications
We Have
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LIFTING DEVICES
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FAST-SAFE-BETTER
Material Handling
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400 MODELS

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PRODUCTIVE

PRODUCTO FOOT PRESSES

These sturdily constructed, bench-type presses are ideal for novelty and small stamping or assembly operations. Available in two sizes, both with high output to input ratio. Write for detailed specification sheets.

THE PRODUCTO MACHINE CO.
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DIXON ONE-MAN COIL GRAB
CUTS TIME AND COSTS WITH ONE-MOTION REEL LOADING

Saves labor and speeds coil handling. One man can lift, turn, and load coil with a single, easy motion. Positive grip and support eliminate coil damage, assure operator safety. Forged steel wedge separates coils easily. Standard sizes up to 15,000 lb. capacity available from stock.

Lifts and turns in one motion.

WRITE FOR COMPLETE DATA—New bulletins illustrate standard models and show how to handle all coil sizes safely, rapidly, without damage. Write for them today.

DIXON AUTOMATIC TOOL, Inc.
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ROCKFORD, ILLINOIS
Equipment for Automatic Parts Handling and Assembly

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NEW *Baj* ONE-PASS KEYWAY PUSH BROACH

This non-adjustable version of the Glenny Adjustable Expansion Broach (formerly produced by the East Shore Machine Co., Cleveland, Ohio) introduces these outstanding features:

- FAST, EASY OPERATION
- REPLACEABLE HIGH SPEED STEEL CUTTING BLADE
- EXCLUSIVE BODY DESIGN
- HIGH ACCURACY—to .0005 plus or minus
- LONG LIFE—up to 100,000 keyways without replacing.
- WIDE RANGE OF STANDARD SIZES

Write for Nearest Distributor.

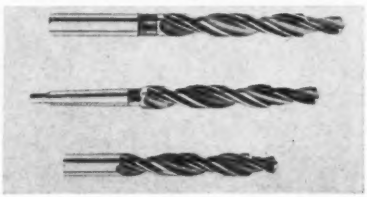
The Baj Tool Company
(Manufacturers of Baj and Glenny Broaches)
19751 St. Clair Avenue
Cleveland 19, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 1083

Machining

PRODUCTS & PROCESSES & PRODUCTS & PROCESSES & PRODUCTS & PROCESSES & PRODUCTS

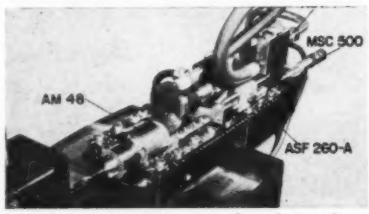
A Standard Subland Drill Line for drilling and tapping operations prior to tapping has been announced by Mohawk Tools, Inc., Montelier, Ohio. All tap drill sizes from



#10 to 5/8 in either NC or NF, in three step lengths and three shank styles are available. Write to the company for a catalog, or Circle Inform-A-Gram No. J1.

A New Grinding Aid, Econogrind, was designed specifically for use in connection with new and existing grinding equipment and techniques. This process, a liquid cooled electrical assist, reduces diamond wheel consumption, produces good finishes, and requires less grinding pressure. Contact Wendt-Sonis Co., Hannibal, Mo., for details, or Circle Inform-A-Gram No. J2.

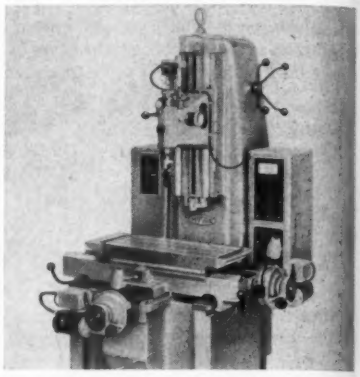
This New Drilling and Milling Pneumatic Power and Feed Unit has two rugged basic air motors that can be fitted either with chucks to drill direct or with gears to drive large drilling and milling heads. The ASF 260 unit has a 1½" dia



drilling capacity and also does reaming, tapping, boring, facing, and milling. For information, write to Automation Tools Inc., Box 331, La Jolla, Calif., or Circle Inform-A-Gram No. J3.

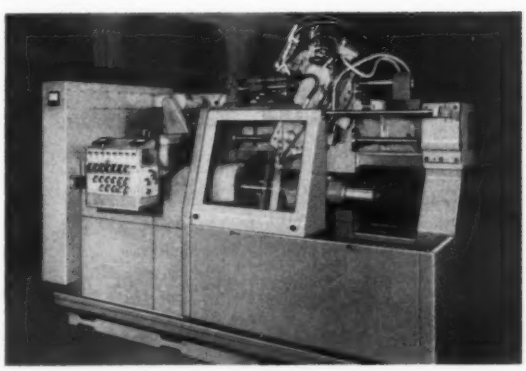
An Electro-Mechanical Machine Management System permits operators to dial change in machine set-up and it can be applied to machine tools and conveyor systems. This system is especially suited to short run production. Contact Seneca Falls Machine Co., Seneca Falls, N. Y., for details or Circle Inform-A-Gram No. J4.

This Universal Measuring Machine features motorized table positioning with accurate horizontal and cross lead screws. It's suited for measuring large workpieces to laboratory tolerances and is capable of



measuring to ⅓ of a ten-thousandth. The machine also features a 11" x 18" x 18" work capacity. Moore Special Tool Co., Inc., 800 Union Ave., Bridgeport 7, or Circle Inform-A-Gram No. J5.

This Sturdy Bed-Type Milling Machine was made for accurate rapid milling of light and medium production. A 4-page bulletin describes Model 1 and how it can be arranged for long and short production runs and toolroom work. For this bulletin, write The Producto Machine Co., 990 Housatonic Ave., Bridgeport 1, Conn., or Circle Inform-A-Gram No. J6.



This Rugged Tracer Lathe, combined with a choice of machine components, meets a wide range of specific turning requirements. Model 30 accommodates one of two tracing units. One performs a single tracing cut in an automatic cycle, while the other provides two automatic tracing cuts with an indexing toolholder. Jones & Lamson Machine Co., Springfield 16, Vt., or Circle Inform-A-Gram No. J7.

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PRECISION PLASTIC • NON-BREAKABLE
COMPARATOR SCALES

Highly accurate and designed for making quick measurements at scale on projectors and comparators without any movement of machine or work.

Supplied on Gage Company Precision Plastic . . . a sturdy, non-breakable material of constant stability, .125 in thickness.

Unexcelled as a tool for use in drafting and engineering scale layouts for use on comparators.

Available in all standard magnifications and in several lengths. Various styles for all applications.

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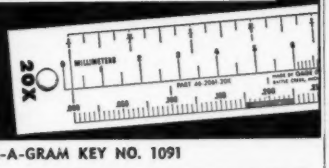

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DIE SPRINGS

Stock or Special Sizes
Medium, Medium-Heavy, Heavy Duty

Distributed by leading die set manufacturers

5833

Wide variety of hole and rod sizes, lengths, deflections. Increased fatigue life. Reduced down time. *Write for specifications and price list, and name of nearest distributor.*

Raymond Manufacturing Division
Associated Spring Corporation
Corry, Pennsylvania

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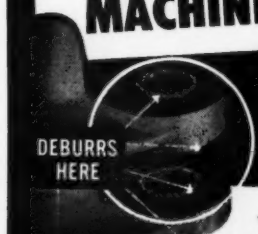
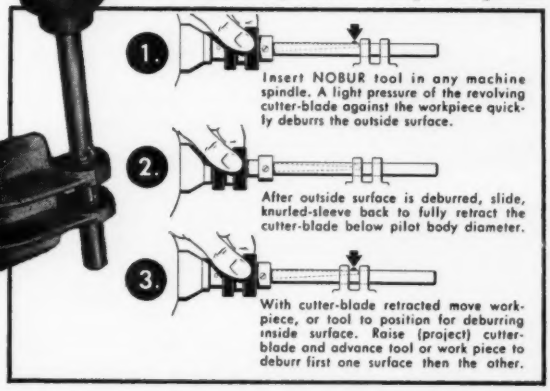
How to... DEBURR THESE INACCESSIBLE HOLE FACES BY MACHINE OPERATION



★ faster
★ better
★ easier

with the amazing
NOBUR TOOL

No more hand-finishing methods for those hard-to-get-at inner surfaces on multi-wall parts. The NOBUR Tool with its double edge cutting blade does the job in seconds . . . all by *machine operation*. Can be used by anyone, with complete safety, on your own lathe, drill press, etc. Simple to operate.

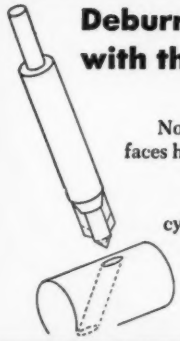


1. Insert NOBUR tool in any machine spindle. A light pressure of the revolving cutter-blade against the workpiece quickly deburrs the outside surface.

2. After outside surface is deburred, slide, knurled-sleeve back to fully retract the cutter-blade below pilot body diameter.

3. With cutter-blade retracted move workpiece, or tool to position for deburring inside surface. Raise (project) cutter-blade and advance tool or work piece to deburr first one surface then the other.

HERE'S ANOTHER PROBLEM SOLVED



Deburring Elliptical Holes with the NEW! ELLIPTI-BURR TOOL

Now . . . deburr openly accessible hole faces having an irregular surface like those developed when holes are drilled angularly or when drilled through cylindrical bodies. This revolutionary tool is self-piloting with a two-lipped cutter that automatically follows the hole surface geometry. Write for full data.

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Send for all the details on Nobur Tool Products — the key to *lower* costs, *higher* production and *improved* quality on your deburring operations. WRITE TODAY!

NO/BUR TOOLS NOBUR MANUFACTURING CO.
6860 Farmdale Ave., No. Hollywood, California

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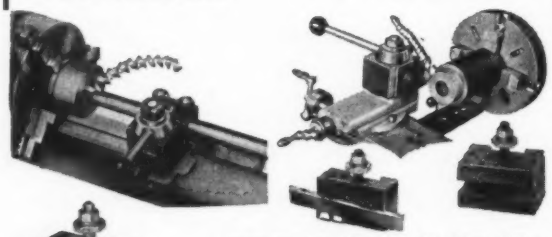
QUICK CHANGE
TOOL POSTS & TOOL HOLDERS

FOR MAXIMUM VERSATILITY & RIGIDITY



Change tools instantly—for turning, facing, drilling, boring, threading, knurling, cutting off or any operation.

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- Unlimited Versatility
- Saves 90% Set-up Time, 50% Production Time
- Greater Rigidity
- Leading Lathe Mfrs. Recommend It
- Sizes to Fit Every Lathe
- Unconditionally Guaranteed

NEW! Aloris Holder for Carbide Triangular Inserts. For both positive rake and negative rake inserts. The most complete line of tool posts and holders.

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ALORIS TOOL CO., INC. 419 Getty Avenue Clifton, New Jersey

CIRCLE INFORM-A-GRAM KEY NO. 1101

DEKA BORE

OFFSET BORING HEADS

UNPARALLELED

- ACCURACY
- RIGIDITY
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REPEAT TO .0001" IN 30 SECONDS WITHOUT BACKLASH! CAN BE ADAPTED TO FIT ANY MACHINE

100% GUARANTEED! WRITE FOR CATALOG!

PRECISION

PRECISION TOOL & MFG. CO. of ILLINOIS
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Aget offers more! Over 38 standard Dustkop models to choose from . . . *Plus* engineering service to help you select, provide, and install the proper accessories and fittings to complete your dust collecting system. Write for illustrated folder . . . Today!

AGET MANUFACTURING COMPANY
1394 E. CHURCH STREET • ADRIAN, MICHIGAN

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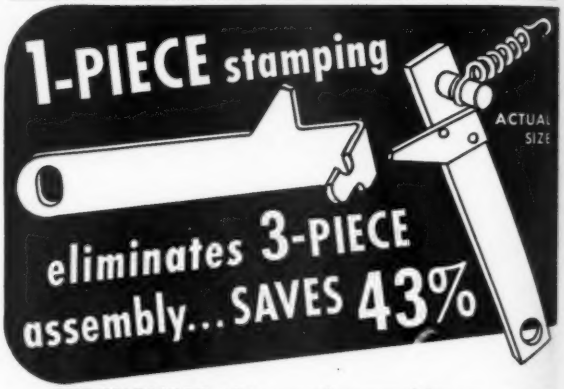


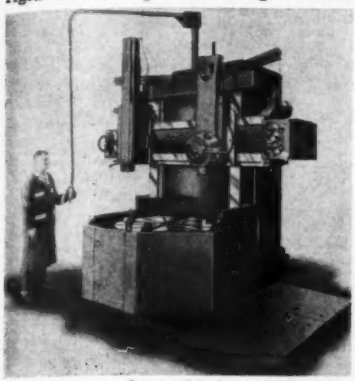
REDESIGNING this pawl assembly to a one-piece stamping gave the customer exact duplication plus lower cost. Formerly fabricated at $1.00 each, the first 100 stampings cost 57¢ each. The next 100 pieces will show a savings of 95%.

Got a fabrication problem? Chances are it can be solved with short-run stampings using the D-R method of utilizing temporary tooling. Send your print and/or sample, plus quantity, for prompt quotation. No obligation.

DAYTON ROGERS
Manufacturing Company

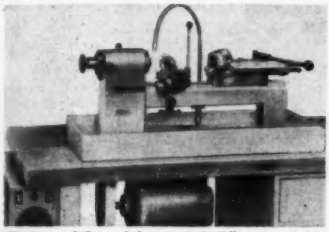
MINNEAPOLIS 7B, MINNESOTA
CIRCLE INFORM-A-GRAM KEY NO. 1104

This All-Electric Vertical Turret Lathe is compact and uses ⅓ less floor space than other machines of the same rated capacity. It holds rigid close-coupled tooling needed



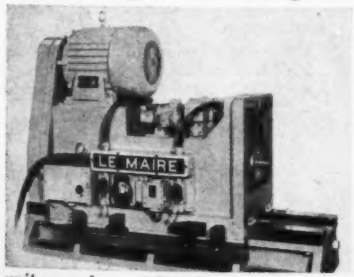
for high speed machining with carbides and ceramics, and has 32 table speeds, a low range from 5 to 67 rpm, and high range from 20 to 272 rpm. Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., or Circle Inform-A-Gram No. J8.

This New Precision Instrument Lathe is used for production, instrument, and tool work. Made with enclosed head stocks, V-belt drives, and tubeless variable speed control, the lathe has spindles made for



collets with either 3/16" or 5/16" capacity. Get Catalog T from Louis Levin & Son, Inc., 3610 S. Broadway, Los Angeles 7, or Circle Inform-A-Gram No. J9.

Provide Power for many machine tool operations with this SU-5 way-type hydraulic unit. It can be mounted horizontally or vertically on machines for drilling, reaming, milling, boring, or chamferring. The



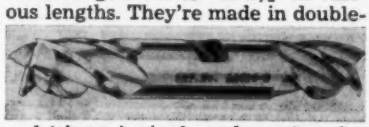
units can be used over and over for a wide variety of applications because of their building block construction. Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich., or Circle Inform-A-Gram No. J10.

A New Type of Throwaway Insert Milling Cutter has been added to the line of The Viking Tool Co., 1000 Nichols Rd., P. O. Box 471, Shelton, Conn. The cutters utilize the ¾" square positive rake throwaway carbide inserts, and provide very high feed rates and stock removal capacity with no regrinding. Applications range from aluminum to heat treated, high heat-resistant stainless steels. Get details from the company or Circle Inform-A-Gram No. J11.

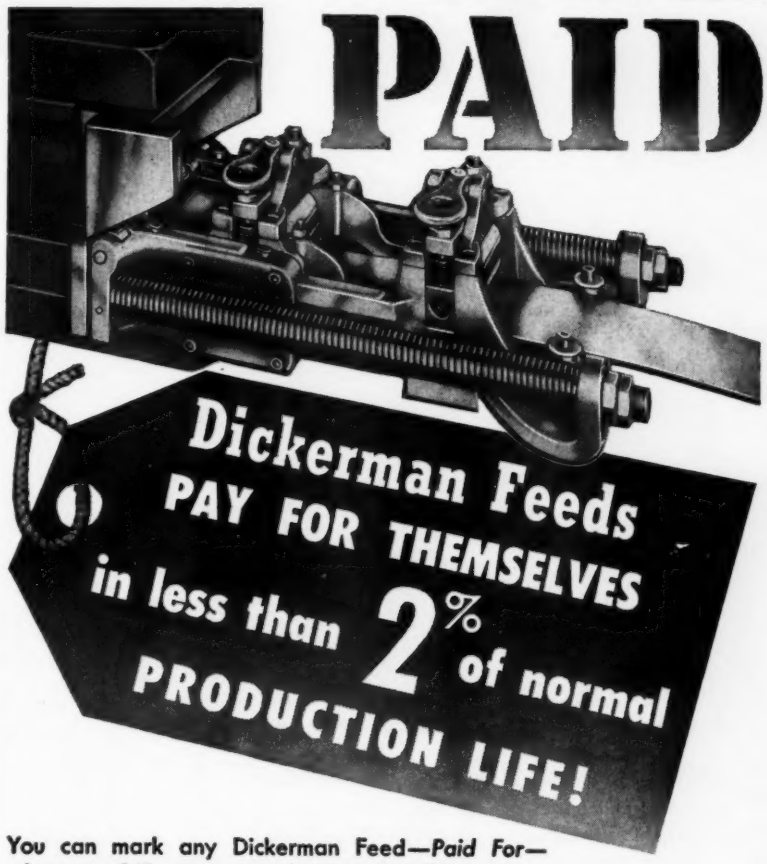
Machining

PROCESSES & PRODUCTS & PROCESSES

These Four-Flute Center-Cutting End Mills permit plunge cutting, and the smoother cutting action of four flutes assures a finer finish. Sizes range from ⅛" to 1½" in various lengths. They're made in double-



end (shown), single-end regular, single-end long, and single-end extra long. The Weldon Tool Co., 3000 Woodhill Rd., Cleveland, or Circle Inform-A-Gram No. J12.



You can mark any Dickerman Feed—*Paid For*—after only 2% of its normal production life.

Yes, only 1¾¢ per 1000 pieces for the first 2,000,000 run pays for a 3" Die-Feed . . . Then, you get up to 98,000,000 trouble-free pieces at no cost.

Dickerman Feeds produce a hundred million pieces with reasonable care, without maintenance, continually.

To be really competitive . . . you can't afford to feed punch presses any other way—Contact Dickerman today!

Dickerman

Send for literature on the 14 "standard" money making Dickerman Feeds today!

H. E. DICKERMAN MFG. CO., 321-334 Albany St., Springfield, Mass.

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ENGINEERED Tool Storage!

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in LESS than **3** SQ. FT.

OF FLOOR SPACE!

YES, as many as 1,092 of your valuable tools and gages can be safely and systematically stored in one M & S GAGE STORAGE FILE . . . each tool in its individual compartment . . . adjustable dividers adapt for gages, taps, dies, reamers, form tools, etc.

Saves Space! Time! Costly Damage!

Reinforced construction for lasting service. 3 models to meet your requirements.

Enthusiastic users include General and Specialty Machine Shops, Aircraft, Electronic, and Automotive Industries.

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M & S EQUIPMENT CO., Inc.

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BURR-BIT CUTS TAPPING COST WAY DOWN!

Just lock Burr-Bit on any make tap and holes are deburred automatically, leaving a smooth clean chamfer. ONE OPERATION, ONE SETUP, ONE HANDLING.

NEW ADDITION
Now Burr-Bit fits 3 fluted taps from #6 to ½". Also available to fit any tap 2 or 4 fluted from #2 to ¾".

A quality product made of the finest high speed tool steel for use on almost every material.

WRITE now for complete data and reports from engineers who have adapted Burr-Bit and saved on their tapping operations.
INVESTIGATE Burr-Bit-today.

VERNON DEVICES, Inc.
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World's Largest Exclusive Manufacturer of
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CUTTING CAMS
HIGH SPEED STEEL AND CARBIDE FORM TOOLS
SPECIAL CUTTING TOOLS
SPLIT DRILL BUSHINGS
CROSS SLIDE KNURL HOLDERS
TOOL BITS
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FORMING SWING TOOLS
Standard sizes 00, 0, 2, carried in stock.

We specialize in one thing only... designing and making SCREW MACHINE TOOLS!

47 years experience goes into every tool we make. They come to you ready for use . . . Precision design . . . Skilled workmanship . . . Finest materials.

Our extensive facilities save you TIME . . . MONEY . . . and give you accuracy, quality and quick service.

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1871 Clybourn Avenue • Chicago, Illinois

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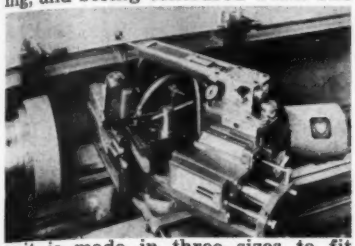
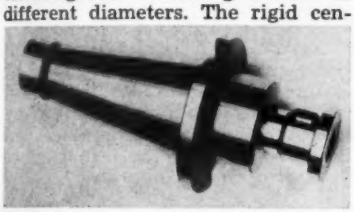
This New Hydraulic Lathe Tracer Attachment features compact, single unit design and converts any lathe for automatic multiple diameter shaft turning, and for facing, turning, and boring contoured work. The



unit is made in three sizes to fit lathes with up to 27½" actual swing and up to 30 hp. Get information from Leland-Gifford Co., Worcester 1, Mass., or Circle Inform-A-Gram No. J13.

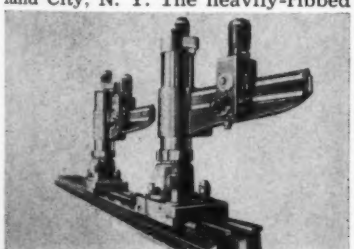
Mechanical Features and complete specifications of 59 Supreme industrial chucks are given in a 14-page catalog. Included is a fold-out specification chart that gives information on related lines. Get a copy of the catalog from Supreme Products Corp., 2222 S. Calumet Ave., Chicago 16, or Circle Inform-A-Gram No. J14.

This Milling Machine Arbor consists of a base arbor which remains in the spindle and three or four interchangeable centering inserts of different diameters. The rigid cen-



tering inserts are guided for their entire length to absorb the axial and radial forces. Get a bulletin from A. & H. von Tsurikov, 755 Lake Ave., Rochester 13, N. Y., or Circle Inform-A-Gram No. J15.

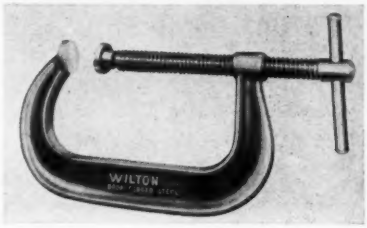
Power Carriages moving on ways at 12 ft/min are available on the 5′, 7′, and 8′ Caser radial drills announced by Hermes Machine Tool Co., Inc., 48-15 Northern Blvd., Long Island City, N. Y. The heavily-ribbed



bases come in 10′ and 13′ long individual components and can be assembled together for continuous travel of the carriage. Write the company for information, or Circle Inform-A-Gram No. J16.

Automatic Hydraulic and Tape-Controlled Turret Drills are explained in a 12-page bulletin which gives details on how the hydraulic machines are set up for operation. Preselected speed changes, depth control, and feed rate for each spindle are discussed. Burg Tool Mfg. Co., Inc., 15001 S. Figueroa St., Gardena, Calif., supplies this catalog, or Circle Inform-A-Gram No. J17.

Increased C-Clamp Strength has been accomplished by the introduction of heat treated corrosion resistant spindles on the 400 and 900 Series clamps. The heat treated spindles are much stronger, and will resist much greater force without bending or shearing. Get information from Wilton Tool Mfg. Co., Inc., Schiller Park, Ill., or J18.



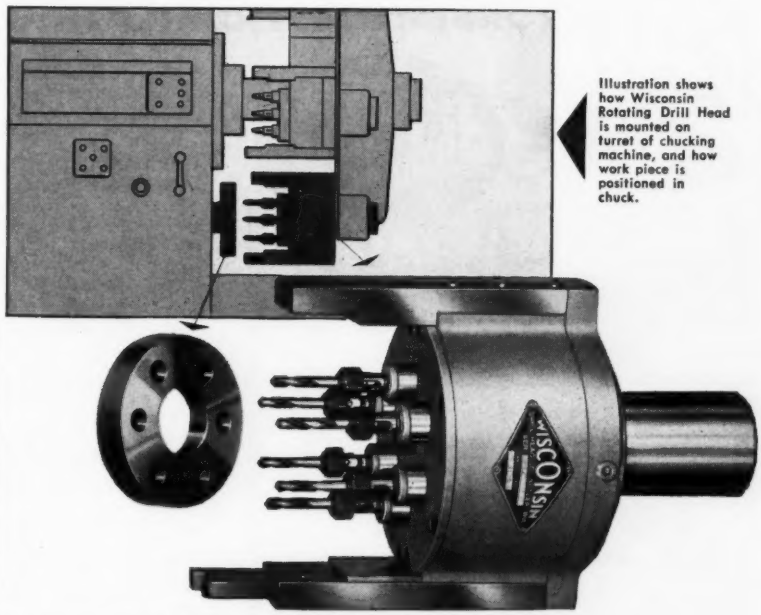


Illustration shows how Wisconsin Rotating Drill Head is mounted on turret of chucking machine, and how work piece is positioned in chuck.

WISCONSIN Rotating Heads for your Automatic Chucking Machines

Rotating Drill Heads and Tapping Heads by Wisconsin are winning wide favor because of their efficient performance on popular makes of automatic chucking machines and lathes. If you have a drilling or tapping operation to perform at low cost, consider the application of one or more of these heads specially engineered to your specifications. The Wisconsin engineering staff is qualified by training and experience to assist you in tooling for high speed, low-cost production. Send your "specs" and prints for quotation.

CONSULT OUR FIELD ENGINEERS OR WRITE —

WISCONSIN DRILL HEAD CO.

4975 NORTH 124TH STREET • BUTLER, WISCONSIN

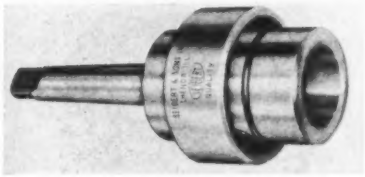
A8-9447-161

CIRCLE INFORM-A-GRAM KEY NO. 113

Machining

PRODUCTS & PROCESSES & PRODUCTS

A Quick Change Tool gives multiple-spindle versatility to single-spindle drilling machines. Magic Chuck requires only seconds to change from one tool to another, making it valuable where drilling, reaming, and tapping operations are done in succession. Get information from Seibert and Sons, Inc., Chenoa, Ill., or Circle No. J19.

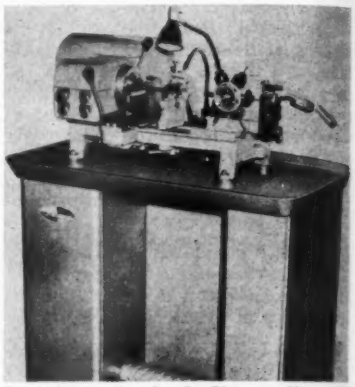


A Line of Detachable Milling Machine Arbors and adapters with live bearing supports has been announced by J & S Tool Co. All models

in the No-Bend line are hardened an ground to prevent set. The arbors are interchangeable with 40 to 50 taper adapters, permitting more continuous milling machine operation and consequently greater production. For information, Circle Inform-A-Gram No. J20.

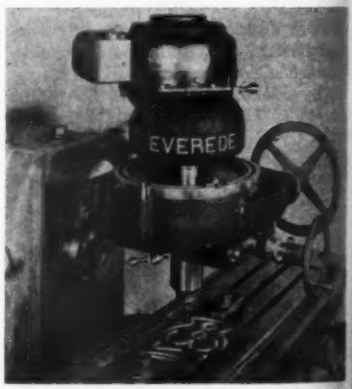
Ceroc Ceramic Tool Inserts, and toolholders, are explained in a bulletin which discusses what Ceroc is and how it should be used. Designed for either roughing or finishing work, they increase cutting speed and production and extend tool life. Specifications are given for different types of tools. Get this bulletin from Gulton Industrial, Inc., Metuchen, N. J., or Circle No. J21.

Save up to 50% of Machining Time on short runs or secondary operations using the new, small, semi-automatic precision turret lathe manufactured by The Challenge Machinery Co., Grand Haven, Mich.



It takes standard ⅝" tooling and features the Auto-Index turret and steady rest which are controlled by the special operating handle. Get Bulletin 865 from the company, or Circle Inform-A-Gram No. J22.

A New Rotary Head Milling Attachment is for use with horizontal or vertical milling machines. It features direct drive, double rotary worm shaft, and cross-slide screw. The attachment also has a



large 10" pitch diameter worm gear and spring pusher on the worm to assure constant engagement with no backlash, permitting heavy-duty climb milling cuts. Everede Tool Co., 2000 N. Parkside Ave., Chicago 39, supplies literature, or Circle J23.

Speed FORMING and FABRICATING

New 36 page catalog . . . packed with time saving "Die-Less Duplicating" techniques

O'NEIL-IRWIN MFG. CO.

di-acro PRECISION METALWORKING MACHINES

"Consult the yellow pages of your phone book for the name of your nearest Di-Acro distributor or write us."

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Benders 5 Models
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Punch Press 2 Models
Power Punch 2 Models
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Powershear 4 Models

CIRCLE INFORM-A-GRAM KEY NO. 114

YOU'D BE LATE, TOO, if you had the trouble I've had in my toy shop. We never had such a demand—rockets, space ships, burp guns—I thought we'd never make enough. You can bet that we'll use Threadwell Cutting Tools next year so our production will run smoothly. And can you imagine . . . those wiseguy reindeer want overtime. *Photo by Cobb Shinn for Threadwell Tap & Die Co., Greenfield, Massachusetts.*

CIRCLE INFORM-A-GRAM KEY NO. 1151

OH BUOY, SAM . . . Think of all the time we could spend together if you'd only get things straightened out at the shop. There's a little old Threadwell Distributor down here who says that if you used Threadwell cutting tools you'd have more time and money . . . for me. *Photo by Peter Gowland for Threadwell Tap & Die Co., Greenfield, Mass.*

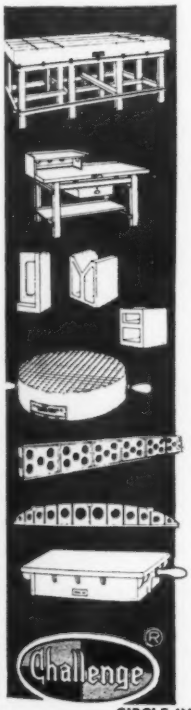
CIRCLE INFORM-A-GRAM KEY NO. 1153

Over ~~300~~ 400 types and sizes of

PRECISION SURFACES

for LAYOUT, INSPECTION and ASSEMBLY

In Semi-Steel, Granite, Aluminum and Magnesium



Close tolerance precision work demands Precision Surfaces, and Challenge offers the broadest line of standard precision items to meet almost every precision need. This includes Angle Plates, V-Blocks, Straight Edges, Surface Plates and Floor Plates plus new lightweight Aluminum and Magnesium units. In addition, special types and sizes of precision surface equipment can be made to meet specific needs.

SE-116A

Ask for catalog information including complete specifications and prices. See your Industrial Distributor or write Challenge today.

Dept. TP-2

THE CHALLENGE MACHINERY CO.

Grand Haven, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 1152

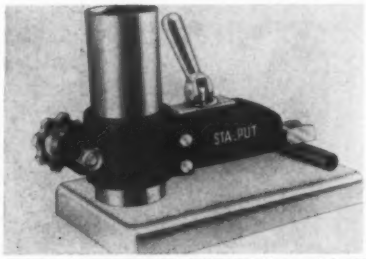
I'D BE SO NICE TO COME HOME TO Harry, if you didn't bring your work, too. I don't know much about gages but that nice young man next door says that his plant standardizes on Threadwell Gages. He has plenty of free time. Maybe you would, too, if you tried Threadwell Gages in the shop. *Photo by Peter Gowland for Threadwell Tap & Die Co., Greenfield, Massachusetts.*

CIRCLE INFORM-A-GRAM KEY NO. 1154

Machining

PRODUCTS & PROCESSES & PRODUCTS

Securely Hold Almost Any Shaped Workpiece for easy, accurate drilling with the Sta-Put drill press clamp. A split collar permits easy attachment to the drill press column without removing the drill press head, and the cam-locking toggle handle instantly clamps and releases material. Get a bulletin from Termite Drills, Inc., 98 N. Lotus Ave., Pasadena, Calif., or Circle Inform-A-Gram No. J24.



Precision Milling Machines are introduced in a catalog which gives specifications for Models 300, 400, and 500 in chart form. Features and vertical attachments are also given in the catalog available from Heald Machine Works, 1835 Stewart Ave., Springfield, Mo., or No. J25.

SYNTRON Vertical Vibratory

PARTS FEEDERS

Lower production costs by reducing parts handling costs

SYNTRON Parts Feeders automatically orient and feed small parts of almost every size, shape and material to automatic assembly machines, such as shown in photo above, at instantly controlled rates of flow to match production line speeds—without breaking or damaging parts. They are easily adaptable to most operations by the use of gravity feed tracks that deposit parts where and as they are needed.

Working on an electromagnetic principle eliminating motors, gears, bearings, and etc.—SYNTRON Parts Feeders assure less down time and lower maintenance.

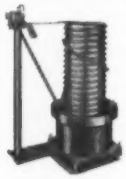
SYNTRON can help with all your parts handling problems—

Write for illustrated brochure — FREE

SYNTRON COMPANY

341 Lexington Avenue Homer City, Pa.

Other SYNTRON Equipment of proven dependable Quality



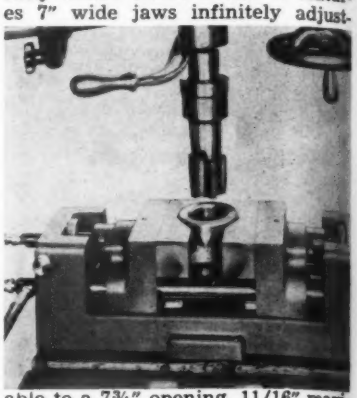
TRANSFER & STORAGE FEEDERS

LAPPING MACHINES

BATTERY CHARGERS

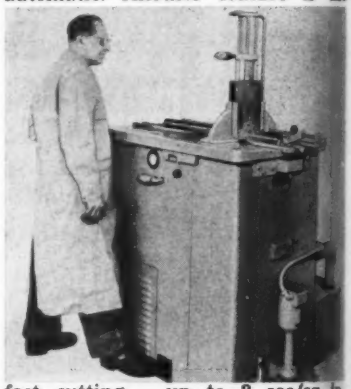
CIRCLE INFORM-A-GRAM KEY NO. 116

This New Air-Hydraulic Vise is designed for holding parts varying in size and shape, and to automatically center them. Model 77 features 7" wide jaws infinitely adjustable to a 7¾" opening, 11/16" maximum travel for each jaw, and 1⅜" total travel. Heinrich Tools, Inc., Racine Wis., or Circle Inform-A-Gram No. J26.



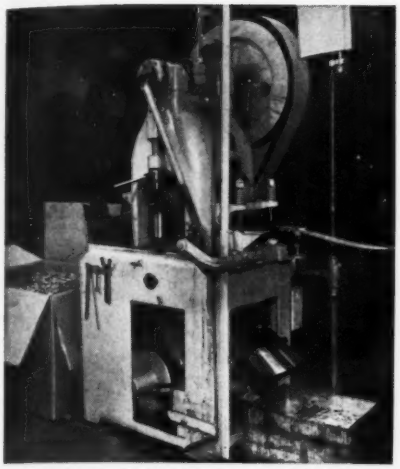
An Automatic Drill Feed and an automatic deep hole driller are featured in a bulletin. Outstanding features, specifications, and operational data are included for both units. For your copy, write The General Tool Div'n, The General Fire Extinguisher Corp., 8740 Washington Blvd., Culver City, Calif., or Circle Inform-A-Gram No. J27.

The Bullard Cutoff Machine features a wheel which feeds vertically within the rugged frame construction for maximum safety. Wheel feeding and work clamping are semi-automatic. Another feature is the fast cutting — up to 2 sec/sq in, depending on the material. Write to James Smith & Son,, Inc., 902 Southbridge St., Worcester 10, for a copy of the bulletin, or Circle Inform-A-Gram No. J28.



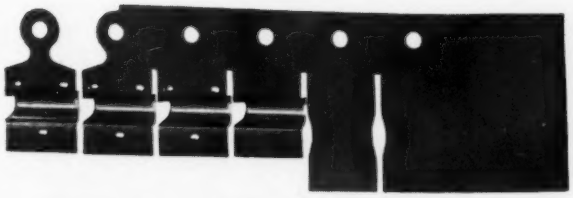
Ram-Type Automatic Turret Lathes with Lynn hydraulic drives are discussed in a bulletin which includes information on operation, feed range, spindle speeds, and special operational features. A table of specifications is also given. Get a copy from Jones & Lamson Machine Co., Springfield, Vt., or Circle Inform-A-Gram No. J29.

1500% MORE Pieces Per Die Sharpening on DIEBEL with *Exclusive Cylindrical Ram*



NEW METHOD produces 500,000 to 800,000 pieces per die sharpening with very little punch breakage. Production is 42,000 pieces per shift on one 12 Ton DIEBEL Hi-Production Automatic Press and quality of pieces is better. Here is dramatic proof that DIEBEL'S exclusive cylindrical ram cuts die deflection to an absolute minimum.

5 Station die produces 500,000 to 800,000 calendar pencil clips per grind from .008" stock at Brown & Bigelow plant in Minneapolis.



WHEN THIS PART was moved from an O.B.I. to a DIEBEL 12 Ton Hi-Production Automatic, production increased from 50,000 to as high as 800,000 pieces per grind with less punch breakage.

OLD METHOD required three dies that had to be sharpened every 50,000 pieces. Punch breakage was high. It took two O.B.I. presses working two shifts to produce 25,000 pieces per day.

Sales Service Mfg. Co.

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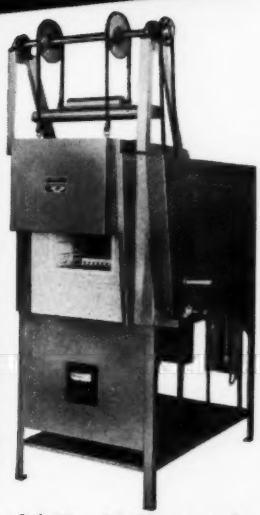
CIRCLE INFORM-A-GRAM KEY NO. 1171

HUPPERT
Floor Model Furnaces

Built in 28 Standard Sizes

- Continuous operation to 1850°F. — intermittent to 1950°F. — for 2300°F. on special order.
- Complete with indicating electronic controller.
- Tight-sealing, wedge-type door.
- Standard for 220 V. AC, single or 3 phase operation—110 V. or 440 V. on special order.
- Multi-insulation for maximum efficiency.

Request literature on complete line of Huppert Furnaces



Model No. 16 Illustrated
Inside Dimensions 12" W. x 8" H. x 18" D.
$1050.00 complete

K. H. HUPPERT CO.
Manufacturers of Electric Furnaces and Ovens
6820 Cottage Grove Avenue Chicago 37, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 1172

ARMSTRONG
TOOL HOLDERS

A Correct Tool for Every Lathe Operation

You can save time (and money) by ensuring that your machine tools are equipped with *adequate numbers* of the correct ARMSTRONG Tool Holders. The ARMSTRONG System of Tool Holders includes correctly designed tools for *every* standard operation on lathes, shapers, and planers, and for many operations on turret lathes and screw machines. By utilizing the ARMSTRONG System of Tool Holders, you can reduce tooling costs, eliminate down time in tooling up, operate your machine tools at maximum feeds and speeds.

ARMSTRONG Tool Holders are long-lasting tools. They are strong beyond need, handy and efficient, profitable to use, and are readily available from your local ARMSTRONG Distributor.

Check over your ARMSTRONG Tool Holder needs. Write for literature.

If you do not know the name of your local ARMSTRONG Distributor, inquire when asking for literature.

ARMSTRONG BROS. TOOL CO. 1320 N. ARMSTRONG AVE. CHICAGO 40, ILL.

CIRCLE INFORM-A-GRAM KEY NO. 1173

Machining

PRODUCTS & PROCESSES & PRODUCTS

This Two-Gal Mistic Mist Cool-and Generator can be cleaned and refilled without disconnecting it from the shop air line. Model 2 RH

has a lead-coated tank and an exterior sight glass for visual coolant level indication. It's used for all types of machining operations. Aetna Mfg. Co., 188 S. York Rd., Bensenville, Ill., or Circle Inform-A-Gram No. J30.

"Thinwall Drill Jig Bushings" is a bulletin which gives complete specifications for eight types of bushings. Technical information such as concentricity, hardness, and lead are given along with diagram drawings of the various types. Get this bulletin from American Drill Bushing Co., 5107 Pacific Blvd., Los Angeles 58, or Circle No. J31.

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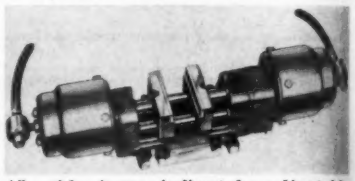
FOR GREATER
PRODUCTION
EFFICIENCY
SAVINGS
Use rugged, reliable "Hole Hog" machine tools for such jobs as:
● Multi-Spindle Boring
● Single and Multi-Spindle Honing
● Straight Line Multi-Drilling
● Adjustable Spindle Drilling
● Vertical and Way-Type Fixed Center Drilling, Boring and Tapping
● Special Multiple Operation Machine Tools
HU110
Universal Joint Type Driller with 18" x 32" drilling area and 16 spindles having 2" joints, each with 2-speed-and-neutral driver. (Above)
HHU84
Three-Way, 74-Spindle Driller using spindle drive units similar to that on HU110 above, but with slip-type spindles.
★ Over 58 years of Machine Tool Engineering experience is at your service. Tell us your particular problem.
MOLINE TOOL COMPANY
100 20TH STREET, MOLINE, ILLINOIS
REPRESENTATIVES IN PRINCIPAL CITIES
CIRCLE INFORM-A-GRAM KEY NO. 118

Position Spindles instead of the work with this new Sundstrand Omnimil discussed in a bulletin. It shows how 15 operations with only one relocation of the part are possi-

ble. Dimensions for two models are given and operational features are pointed out. Obtain this bulletin from Sundstrand Machine Tool Co., Rockford, Ill., or Circle J32.

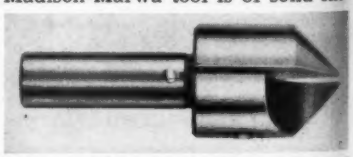
Hold Parts of various sizes or shapes when the work requires the location of a center or other predetermined point, with the Model 11 self-centering air vise that finds this point automatically. It features



4" wide jaws, infinately adjustable to 4⅛" opening. Heinrich Tools Inc., Racine, Wis., or Circle Inform-A-Gram No. J33.

A New Carbide Pricing System of V-R carbide blanks, inserts, brazed tools, and toolholders has been announced by Vascoloy-Ramet Corp., 800 Market St., Waukegan, Ill. Base prices and quantity breaks have been established for both stock and non-stock items. Several new style toolholders are also listed. Get your Price List No. 2 from the company, or J 34.

This New Easy Sharpening Countersink gives burr-free, chatterless performance in a wide range of materials. Made of high speed steel, the Madison-Marwa tool is of solid one-



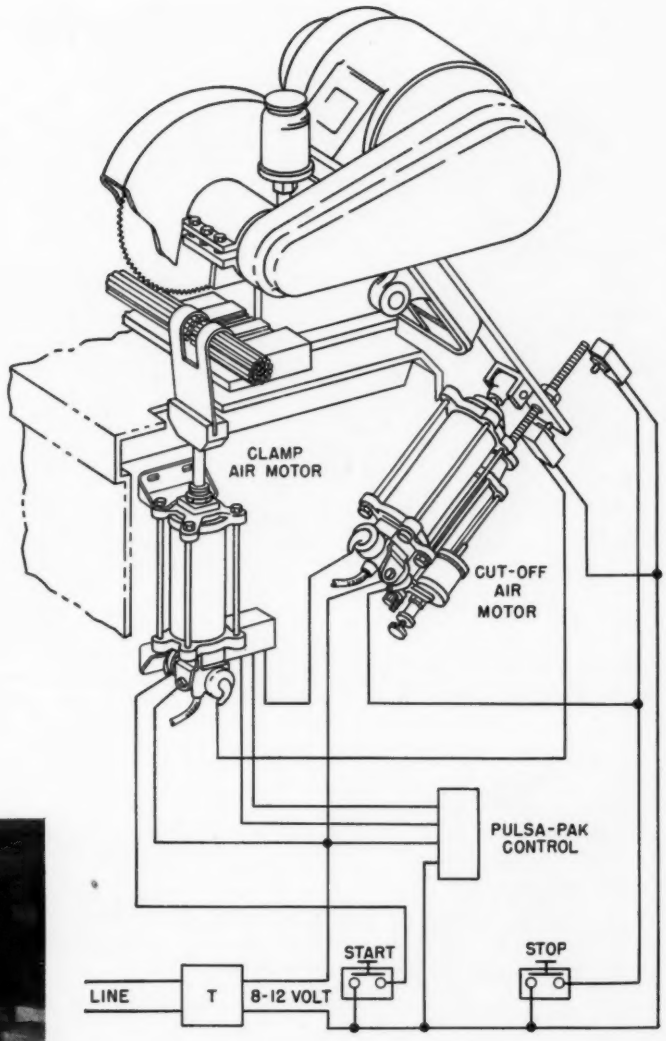
piece construction with a slot cut back from the tip of the cone forming two cutting angles. Ten sizes are available from Madison-Relco Tool Co., Providence, R. I., or Circle J35.

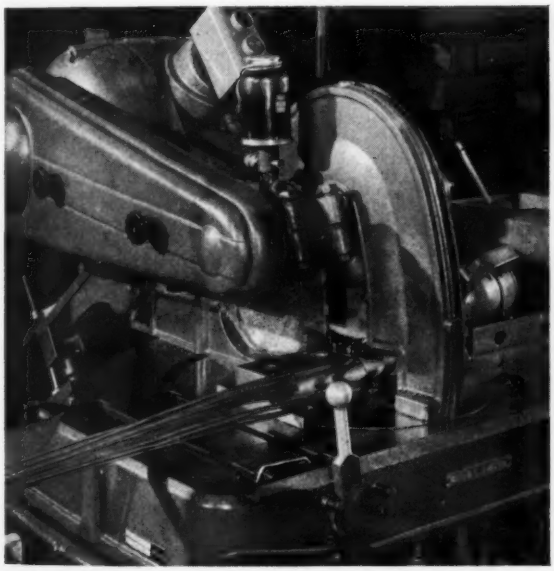
HOW TO MAKE A CUT-OFF SAW PRODUCE MORE AT LESS COST

Shown at the right is a SPOT-A-MATION IDEA used in many plants. Almost invariably it has meant cost savings of 50% or more—has improved product quality, lengthened saw life, lessened worker fatigue.

Two Bellows Air Motors are used. One, hydraulically controlled, feeds the saw through the work. The second clamps the work in position. The two Air Motors are electrically interlocked. The cut-off saw can be made completely automatic by adding a third Air Motor to feed the material.

This is another typical way Bellows Air Motors are used to "Spot Modernize" existing equipment. Almost any hand-fed, or hand-controlled machine can be made to produce more, at less cost, with versatile Bellows "Controlled-Air-Power" Devices.





Typical application of this SPOT-A-MATION IDEA in the plant of Milwaukee Gas Specialties where gas tubing is cut to length. Here costs were cut better than 50% and cost of rejected material reduced 20%.

THIS SPOT-A-MATION IDEA FILE IS YOURS ON REQUEST

Contains drawings, circuit diagrams, equipment list, and full details to enable you to convert existing equipment to lower cost operation. Write for it today. No obligation.

Address Dept. TP259, The Bellows Co., Akron 9, Ohio.

The Bellows Co.

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

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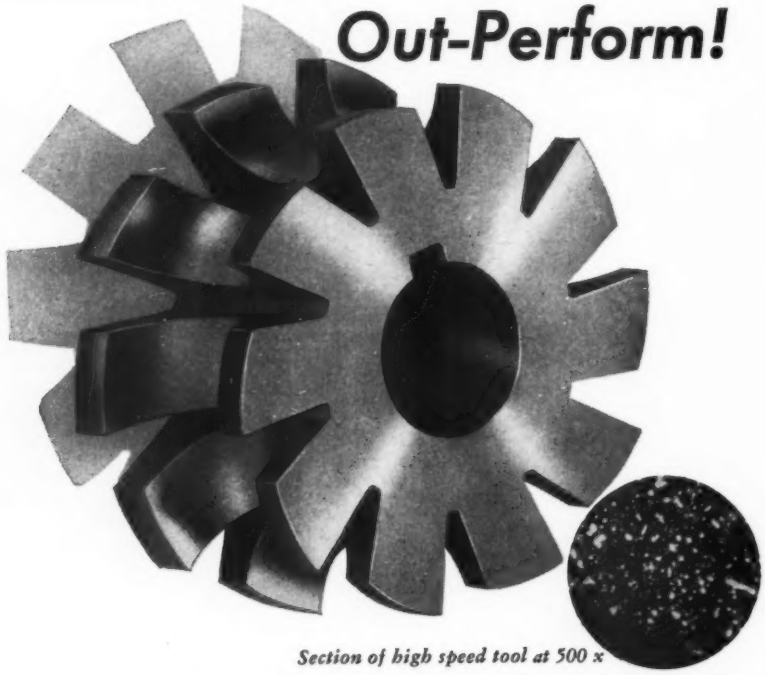
1284-B

OTHER INDUSTRIAL DIVISIONS OF IBEC: Sinclair-Collins Valve Co., Valvair, Akron, Ohio • V. D. Anderson Co., Cleveland, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 119

Sentry-Hardened Tools Out-Perform!



Section of high speed tool at 500 x

The truly neutral Sentry Diamond Block atmosphere permits ample soaking of all high speed or high carbon high chrome production tools to assure uniform hardness throughout.

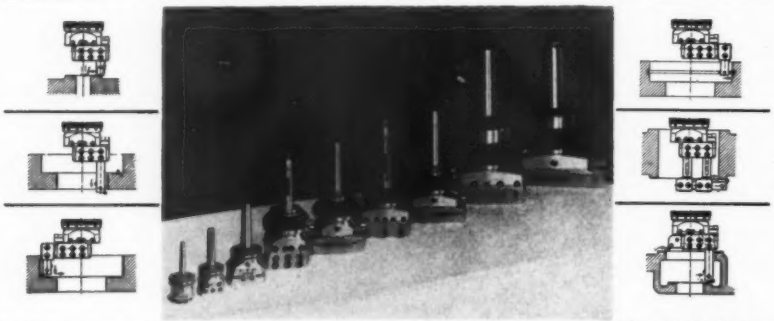
Original sharp edges are retained through the hardening cycle. There is no scale and no decarburization. As a result, tools hardened the Sentry way give maximum service under difficult working conditions.

A demonstration of hardening on your own tools will be convincing proof of Sentry benefits. You're invited to send us samples.

Sentry TRADEMARK **ELECTRIC FURNACES**

Request Catalog B-42 • Write **THE SENTRY CO., FOXBORO, MASS.**

CIRCLE INFORM-A-GRAM KEY NO. 1201



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Facing, Boring, Turning, Recessing, Undercutting, Underfacing, and Tapercutting in one setup

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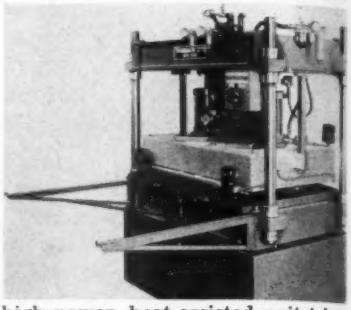
CIRCLE INFORM-A-GRAM KEY NO. 1202

Plastics

PRODUCTS & PROCESSES & PRODUCTS

This Air Hydraulic Die Cutting Press cuts rigid plastics and plastic-like materials efficiently and eliminates costly trimming operations. Using low cost steel rule dies, the



high power, heat-assisted unit trims or finishes workpieces in one quick stroke. Tronomatic Machine Mfg. Corp., 1881 Park Ave., New York 35, or Circle No. K1.

For Curing Epoxy Resins use Activator "W" discussed in a bulletin that gives typical electrical properties of castings and typical physical properties of laminates. Advantages of this curing agent and an epoxy resin adhesive are given. Armstrong Products Co., Argonne Rd., Warsaw, Ind., or Circle K2.

Hysol Materials for adhesives, electrical insulating compounds, and plastic tooling materials are outlined in a new price list from Houghton Laboratories, Inc., of Olean, N. Y. The new quantity discount on certain Hysol compounds used in the electrical insulation and plastic tooling industries is explained. Get a copy from the company, or Circle Inform-A-Gram No. K3.

Molds for Producing Polyester Parts can now be made of epoxies. They can be reproduced at lower cost and more quickly than metal molds. Starting with the model, the gel coating is built up to form the mold. For more information, contact Furane Plastics Inc., 4516 Brazil St., Los Angeles 39, or Circle Inform-A-Gram No. K4.

An Epoxy Adhesive bonds all types of metals, ceramics, carbides, carbon, or materials that can withstand curing temperatures of 260°F. Just heat the parts, rub the stick on them, and assemble and cure. Robert Marks Co., 47 Goddard St., Providence, R. I., or Circle K5.

Examples of Injection Molding, vacuum and drape forming, and assembly and finishing of typical products are shown in a bulletin published by Madan Plastics, Inc., Cranford, N. J. Type of equipment and procedure used are also explained. For a copy of this bulletin, write to the company, or Circle K6.

tap more

Accurate

pieces per hour

with a PROCUNIER TAPPING HEAD!

There's an *extra quality* built into each Procunier tapping head that is automatically reflected in the work produced. They are *precision* units — with the most advanced engineering improvements. In shop after shop — the reaction is the same — "Procunier heads are producing *better, faster, longer,* with *fewer* rejects, *fewer* spoiled pieces".

Procunier heads are noted for their *superior quality.* They offer a new double cone cork faced friction clutch for positive "controlled" driving with finger tip pressure; soft cushioned driving action, ball bearings for smoother, faster operation; heat treated gears; and special balanced reversing mechanism; plus many others. It all adds up to *more* production, *better* production, for *longer* periods, for *less.*

Write for FREE Brochure

giving full details and specifications on the Procunier line of tapping heads.

PROCUNIER SAFETY CHUCK CO.

12-14 S. Clinton St. • Dept. 2, Chicago 6, Ill.

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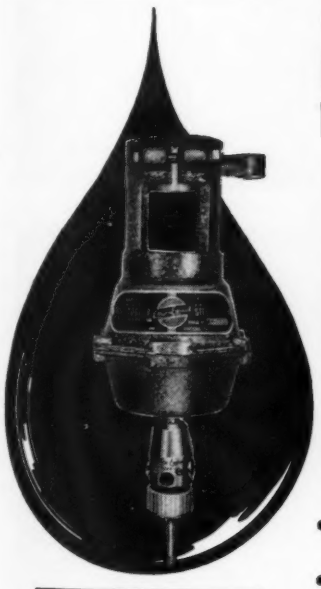

ONLY ETTCO TAPPERS run in oil

- Faster, more accurate tapping
- Smoother running
- Longer lasting
- Much more sensitive
- Sealed in oil
- Fit any drill press

Ettco-Emrick

There's a low cost Ettco Tapping Attachment for every small hole job. Write for complete information — Buy them from your authorized Ettco distributor.

ETTCO TOOL & MACHINE CO., INC.

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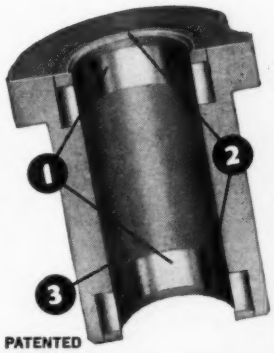
CIRCLE INFORM-A-GRAM KEY NO. 1212

Does the Job of Solid Carbide



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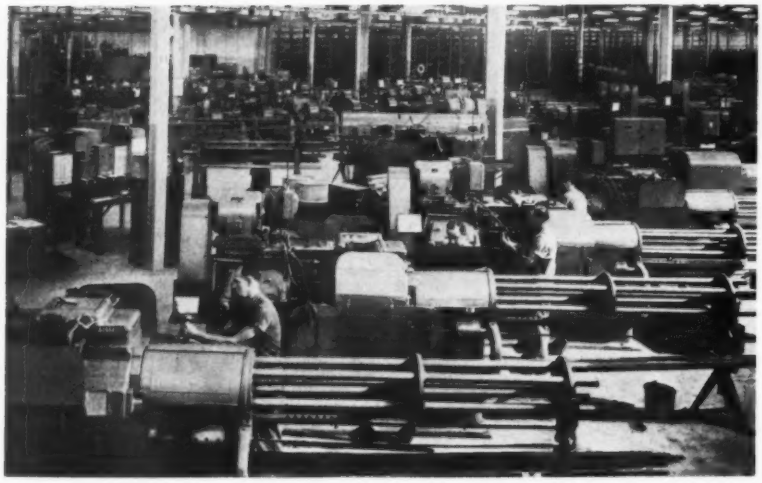
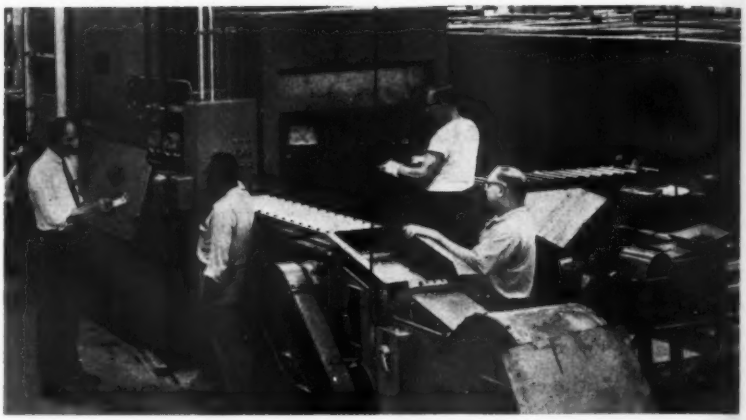
T&P Takes a Plant Tour to . . .



Automatic screw machines operate in Allen's new, almost partitionless, factory building.

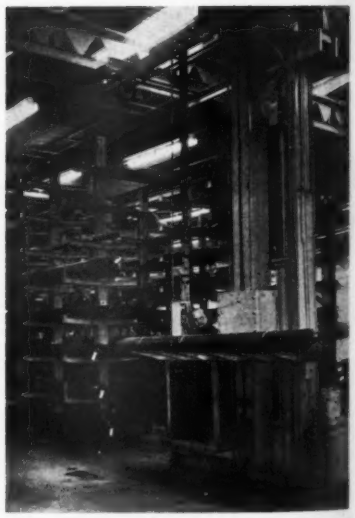
PLANT LAYOUT, equipment, and production techniques of metalworking plants differ widely. To help us to get acquainted with each other, T & P takes you on a "plant tour" via pictures. This month's area of interest is the field of fasteners, and for our picture tour we go to the new plant of The Allen Manufacturing Co., on a 32 acre site near Hartford, Conn. The 250,000 sq ft factory area, expanded metallurgical laboratories, and a new pilot plant, are used for the production and development of Allen Head hex-socket screws and the company's other fastening products.

end



Metal particles that may adhere to products during processing are removed by this vibrating de-chipper.

A large supply of wire stock stored in this area is quickly made available for processing by a special conveyor system.



A special stacker crane, operated by one man, can move freely between the "Christmas Tree" racks.

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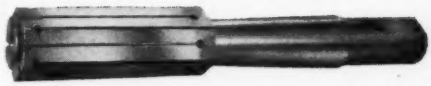
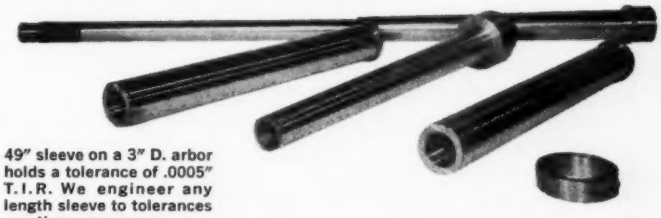
Hex sleeve on a precision arbor. One of many examples of special precision mandrels designed for polygon, tapered bore, and odd shaped holes. Tolerances of .0002" T.I.R. are generally possible.



EXPANDING

3/32" to 3/8" O.D. Aircraft parts production required .0001" T.I.R. on these. One has a threaded nut on arbor to release sleeve in dead-end holes.

MANDRELS



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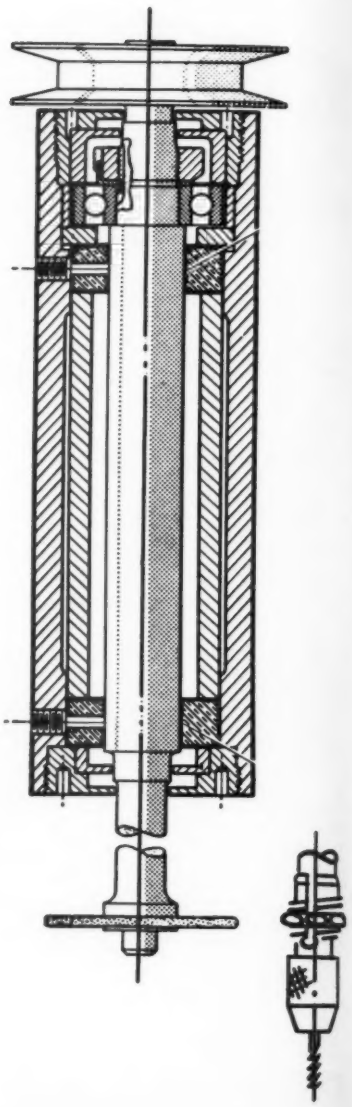
A CARBIDE SPINDLE

. . . for that tough job

Five years ago we ran a report (June 1954, p72) on a spindle being used in the machine shop at the National Aeronautics and Space Administration's (formerly NACA) Cleveland facility. We find it's still in use, doing jobs otherwise impossible—it's assigned to every tough job within its capacity. Here is a brief description of the spindle's construction and something about its recent use.



HAVING SOLID CARBIDE BEARINGS AND A SOLID CARBIDE SHAFT, this spindle was first made for the purpose of grinding blade profiles, using a circular diamond wheel. The blades, in this instance, had constant sections and no twist. It has since come to be used for many jobs, as grinding jet parts made from hard brittle materials where techniques for their fabrication, otherwise, do not exist.

At the time of the decision to build this tool, the main difficulty with spindles was lateral vibration at the cutting tool. However small, this, in conventional spindles, led to excessive wheel wear and breakage of brittle workpieces. Also wheels would break down so fast the accuracies expected couldn't be realized. Even the use of *special* diamond wheels—which increased accuracy—were not feasible since they were still too expensive to consider, as a practical method for grinding turbine wheel blades.

Also spindle variations had caused cyclical variations in the depth of cut for which the abrasive action of the diamond wheel could not fully accommodate. These periodic overloads caused the matrix to break down which resulted in a premature loss of the wheel.

One of this spindle's most important jobs was in a pantograph setup in which case the end mill-like cutters also were solid carbide. In this instance, turbo-pump rotors were cut from the solid.

Much of NASA's work is in the making of integral turbine and rotor wheels where the spindle's ability shines. They recently made 6″ dia rotors having 130 integral blades in each stage (Fig. 1). For this they used a 0.040″ dia end mill in aluminum. Although end mills of this size can only be used on aluminum, they have, in steel, been able to stay down in these small diameters (0.060″) by the use of this spindle.

Run Dry When Possible

Of further interest, their use of the spindle is either with or without the use of coolants—depending on the material being machined. When possible they eliminate the coolant in order to have complete visual control as machining takes place. Of course, the work at NASA is, for the most part, one-of-a-kind prototype work demanding high precision and a low scrap rate. Where necessary they sacrifice tool life to obtain this end.

At the time this spindle came into being 7 years ago, it cost about $2000.00 to build. It is reasonable to assume that the price would be much higher now. However, the price of tapping holes in carbide may be cheaper now than then. They paid approximately $125.00 per hole then. We feel that recent developments in disintegration techniques would probably help hold the price-line if this were to be duplicated today.

One Solid Carbide Bearing

In the first place, R and D appropriations being hard to come by, machine shop personnel proved their theory of the use of a sleeve type carbide bearing, by using only one in the front. After satisfaction, a solid carbide rear bearing was incorporated.

Using every effort to hold the lateral play of the spindle to a minimum, the carbide sleeve bearings were shrunk into the spindle housing, and then ground to a 0.0002″ to 0.0003″ clearance with the solid carbide shaft. Using minimum clearances such as this, previous experience and revving up to grinding speeds dictated the use of a lubricant.

So, a small tank was constructed. It was a reservoir for kerosene and

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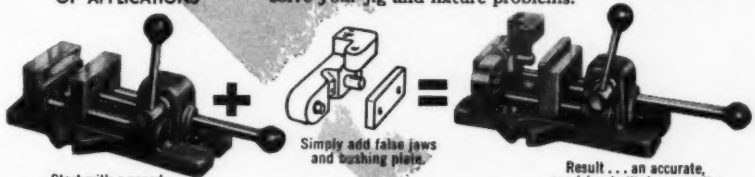
speed production and cut tooling costs up to 75% and occasionally more. One glance at the example below will tell you why more and more cost conscious tool designers, nation-wide, start jigs and fixtures with a Heinrich Grip-Master. It's the easy way to solve your jig and fixture problems.



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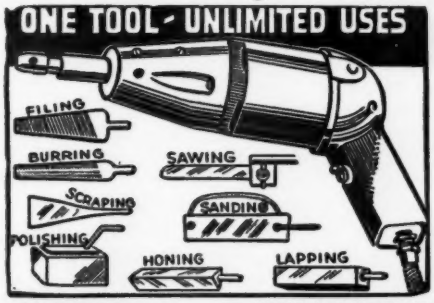

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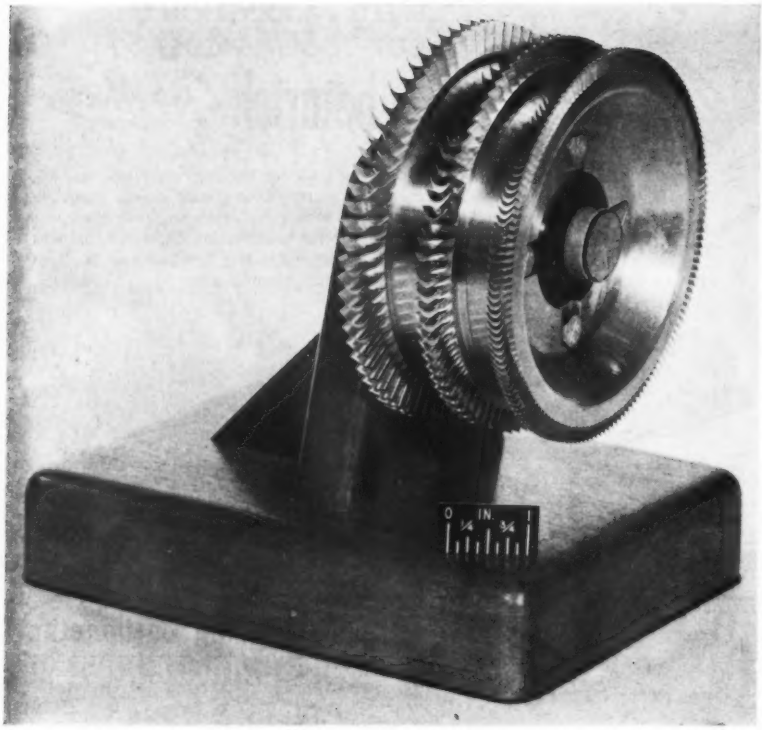


Fig. 1. Here a three-stage rotor is shown, assembled. Each stage was cut from solid aluminum to close tolerances. The one stage carries 130 small blades in its periphery and since writing this article, we have been told that rotors of even more blades have been ordered.

pressurized by plant air. The plant air was reduced to 5 lbs pressure to force the kerosene into the cavity between the front and rear bearing during operation. This worked well and the close fit between the bearing and spindle allowed very little leakage; they say one gallon seemed to last indefinitely.

Also in order to protect their investment, thermo-couples were installed and the temperatures watched on the initial run — the boiling point of kerosene was never reached. In fact, the bearings ran at a comfortable 170° while the spindle rotated at 7200 rpm.

On the sectioned drawing of the spindle, you can see the construction used. Spindle weight, grind-load, end thrust, and vertical movement of the spindle are controlled by fitting the inner race of a commercial ball bearing to the shaft and allowing the outer race to float in the housing with 0.003″ to 0.005″ clearance. The close tolerances held in the journal bearings hold the spindle movement well within the radial tolerance of the ball bearing housing. Thus the ball bearing has no effect on the lateral play of the shaft.

Gives Good Finishes

NASA says this spindle does a beautiful job of milling at grinding speeds (5000 sfpm), without the use of coolants. And depending on the feed, and using circular carbide cutters (or burrs), they realize surface finishes of better than 16 micro-inches.

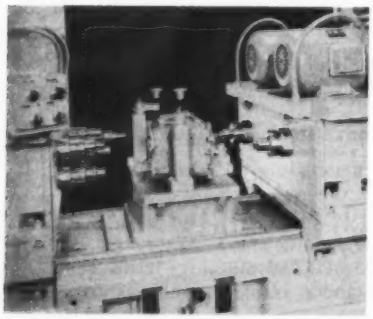
It has been possible to finish grind full sets of experimental pre-sintered carbide high temperature turbine blades without having to compensate for wheel wear, and breakage has been nil. Even though the building of this spindle was expensive, it has been invaluable in their work.

— *W.E.H.*

TWENTY-TWO SURFACES FINISH MACHINED IN ONE CYCLE

A precision boring machine has been installed by a large aircraft manufacturer to machine magnesium gear housings. Utilizing seven spindles, a cluster of five on the left and two on the right, the Ex-Cell-O 17-A boring machine performs a total of 22 operations in one cycle.

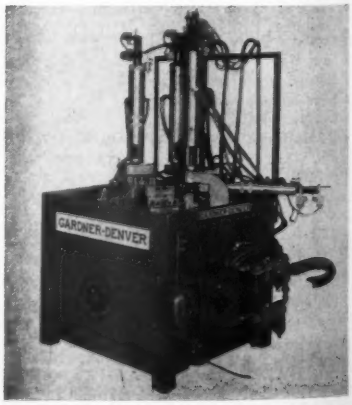
The part is held in a simple hand-clamped fixture. Cycle commences with the table advancing towards the left. Here, five bronze bushings are precision bored together with seven precision counterbores, four plunge facings, and eight chamfering operations. All diameters are held to 0.001″ tolerance and all hole locations held to 0.001″ of true position.



Retracting from the left side of the machine, the table automatically advances to the right. Here two spindles bore two dowel holes to a tolerance of 0.0005″ on diameter and 0.001″ tolerance on center distance. Then the table returns to start position. Output is 51 parts/hr.

NEW DRILLING UNIT PRODUCES TRACK LINKS

Drilling and reaming forged track links are done in a single operation by a construction equipment manufacturer using a 6-station 36″ dia precision dial indexing machine on which seven air-powered drills are mounted. The Gardner-Denver Co. unit can be adjusted easily to drill right or left hand links. Three of the six work stations are available for manual loading and unloading. Set-up time is approximately 20 min.



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- **Mounting surfaces on three sides for installation flexibility**

Find out now—why Holomatic drill units are setting the pace in progressive production plants across the nation. Your Hause representative will gladly demonstrate their multiple dollar-saving efficiencies right in your plant.

Write today *... for demonstration or additional information, specifications and prices on the new Holomatic "Air-Hydraulic" Drill units, "Balanced Air" Threading units, "Lead Screw" Tapping units, complete machines or full line of machine bases and accessories.*

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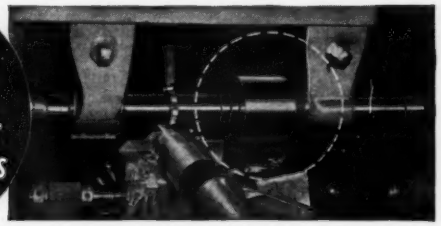
OF ARBOR OUTER SUPPORT BUSHINGS



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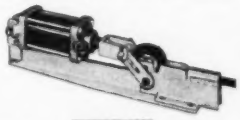

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CUMULATIVE EDITORIAL INDEX FOR 1959 ISSUES

TOOLING & PRODUCTION Magazine

The number of subjects in which T&P's editors present material in just a few issues adds up very rapidly. Most articles are of lasting interest and have future reference value in solving tooling and production problems.

This cumulative index will build up progressively during each calendar year. Each issue will carry a cumulative index of material contained in all previous issues of the same year, with each January issue carrying the complete index of the twelve issues of the previous year.

We suggest you see to it that your copies of T&P are retained for future reference so you can get the full benefit of this new, unique and useful index.

The Publisher

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Welding
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When an automotive parts manufacturer changed to carbide dies for deep drawing small stainless steel instrument panel knobs, reduction of machine downtime during die repolishing was a consideration for cost cutting.

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Additional advantages of the Kennametal dies include improved finish because of low frictional properties of the dies, dimensional tolerances more easily maintained, and a change in die design that enables production of knobs in two draw stations instead of four. Knobs are made of 0.015" thick Type 201 stainless steel, drawn to a depth of 5/8" with a finish diameter of 1".

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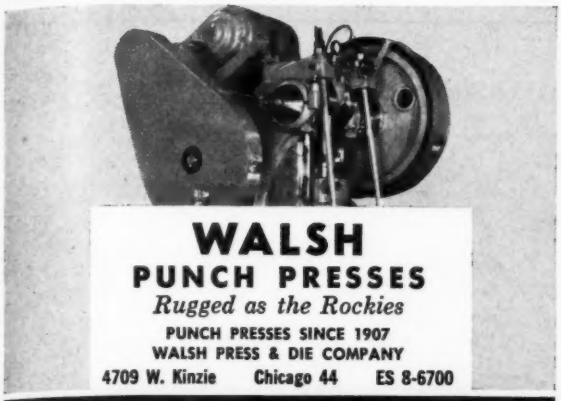

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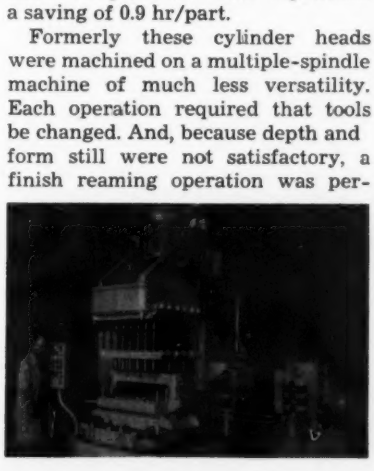

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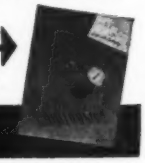

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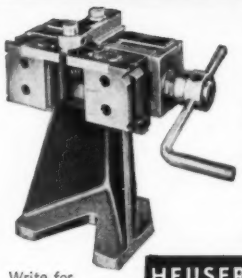

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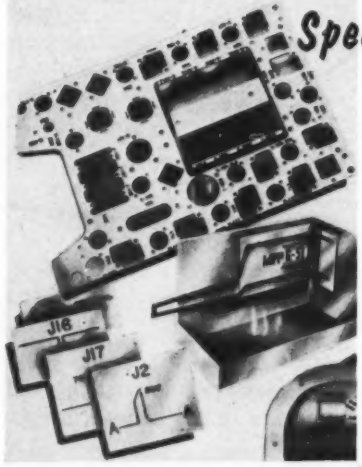

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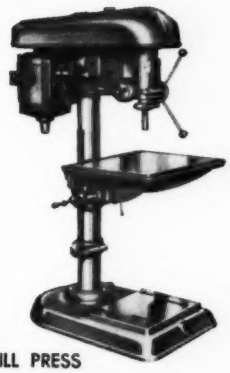

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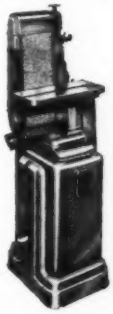

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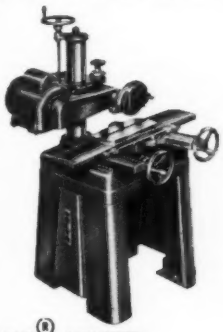

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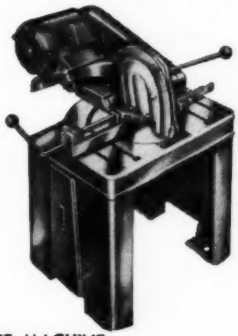

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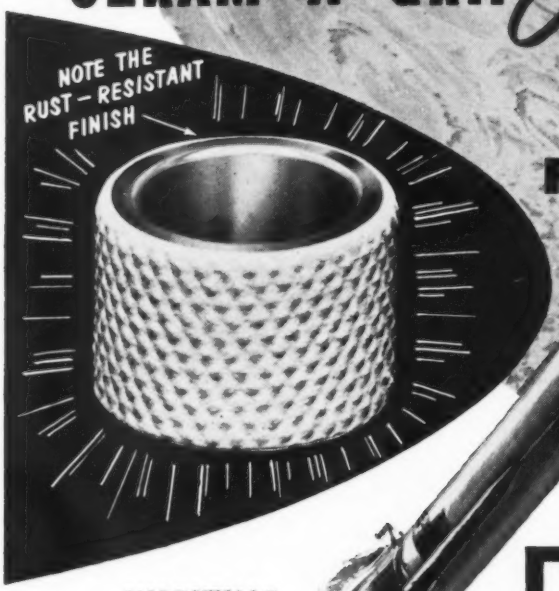

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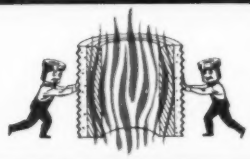

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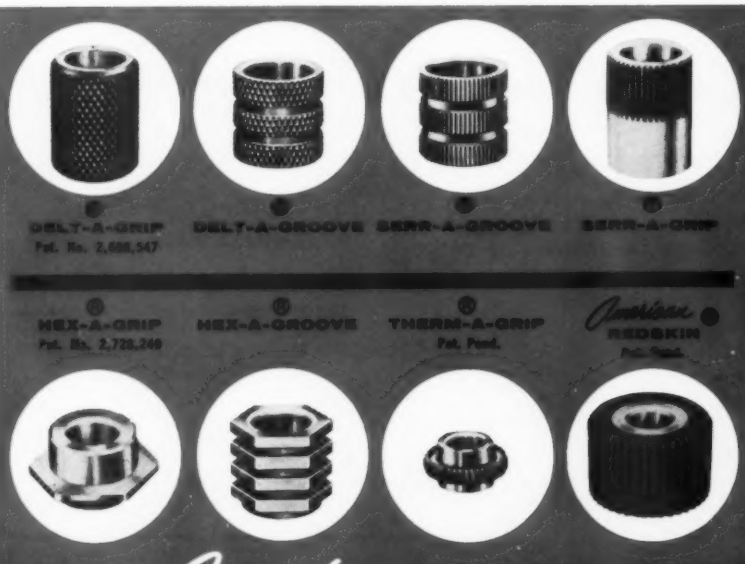

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